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Secţia VIII
TEXTILE. PIELĂRIE

MECHANO-RHEOLOGICAL CHARACTERIZATION OF SOME MELANA-TYPE FIBERS, OBTAINED THROUGH VARIOUS TECHNOLOGIES PART II

BY

OTILIA MÂLCOMETE, FELICIA SĂNDESCU, V. BLAŞCU and MARICEL TAŞCĂ

1. Introduction. The mechanical properties – deformation and, respectively, recurrence capacity – as well as the mechanisms of fiber wearing are influenced by their chemical and morphological structure, and by the intensity and duration of the technological regime of stress.

Clearing up of the mechanism that induce fiber modification during their exploitation is essential for a correct establishment of the optimal processing conditions.

Application of a force field upon a fiber determines a structural reaction localized at a molecular or/and supermolecular level, depending on the stress intensity and on the presence of structural defects (at the level of crystals, of the presence of higher number of defects and fissures in the fiber). Breaking begins alaways from the most dangerous of these defects and is propagating on a trajectory of minimum resistance, along which non-homogeneities, voids inclusions, impurities are to be met [1].

The processes of fiber deformation, induced by the external force applied, develop as a series of specific phenomena from elastic behaviour (characterizing solids) to the viscous one (characteristic to liquids).

Such aspects are evidenced by the "effort-deformation" curves which, considering the shape they have, permit a correct establishment of certain values, by means of which suitable interpretations may be offered, in parallel with the establishment of the domain of optimal processing stresses [2].

A very important problem related to fibers is that discussing the way in which the recurence process occurs, after the fiber has been stressed, for a certain time by a constant force, of a known value. Having in view that fibers are characterized by a visco-elastic behaviour, they are expected to manifest phenomena such as creep and relaxation [3, 4].

The creep represents the increase – with time – of the deformation under the action of a constant effort, while relaxation refers to the decrease – also in time – of the effort, deformation being maintaned constant.

Stress, applied under conditions of creep, stops when removing the effort, the fiber tending to come again to its initial form, within a certain period of time (recurrence period). The way in which this recurrence takes place (as much as possible closer to the initial value and in an as much as possible shorter time) conditions the fiber performances and, consequently, its quality [5, 6]. The creep induces a "static wearing" into the fiber, which is much or less amplified, as a function of structure, stress duration and force value.

All these aspects, referring to the mechanical and wearing behaviour of Melana-type fibers, obtained with the three technological lines at CFS Săvineşti, are discussed both in the Part I [7] and in the present paper.

2. Experimental Part

2.1. Mechanical characteristics. Fibers mechanical properties have been determined from the "effort elongations" curves, recorded on a Fafegraph-type electronic device, under standard conditions.

By applying the Coplan method [8], the following specific values of these curves have been calculated: the initial modulus of elasticity ($E_I = \frac{\sigma}{\varepsilon}$), the visco-elastic modulus ($E_{II} = \frac{\sigma_c - \sigma_e}{\varepsilon_c - \varepsilon_e} \cdot 100$), the limits of elasticity (σ_e, ε_e), flow (σ_c, ε_c), breaking (σ_r, ε_r), as well as the specific deforming mechanical work (Lms, calculated through planimetring of the surface under the effort-elongation curve).

The average values of these characteristics are given in Table 1.

There is observed that, by the process of fixing the ondulations of the filament cable, the values of the elasticity and flow modulus are modified, as well as those of the specific efforts, corresponding to the established limits (σ_e, σ_c, σ_r), in the direction of their diminishing at the fixed samples, as compared with the non-fixed ones. The values of the deformations corresponding to the elastic (ε_e) and flow limit (ε_c) also decrease through fixation. This is not the case of the breaking deformation (ε_r) which increases at the fixed samples, as compared with the non-fixed ones.

Such behaviours, apparently paradoxal, are due to the modification of the fiber structure, as a consequence of thermofixing treatments, i.e., the reduction of the internal tensions created through spinning and drawing and the obtainment of a more relaxed structure of the amorphous phase, more stable from a thermodynamic point of view. In such a situation, the initial slope of the effort-elongation curve (materialized through the modulus of elasticity) decreases, together with the viscoelastic bearing (between the elastic and the flow limit), and the specific breaking effort. At the same time, the deformations corresponding to the limits of the effort-elongation curve of the fixed fibers decrease slightly, as compared with the non-fixed ones, while breaking elongation (ε_r) increases significantly in the case of fixed fibers, as a consequence of increasing the chains mobility, accompanied by breakings of the interchain forces, and of the crystalline structure destruction.

Adjustment of the breaking elongation may be achieved as a function of the thermofixation occurrence, that is, by applying or not a certain tension. From this

Table 1

Mechanical characteristics

The technological line (sample)	Elastic modulus E_I (cN/tex)	Flow modulus E_{II} (cN/tex)	Limits of: elasticity σ_e (cN/tex)	elasticity ε_e %	flow σ_c (cN/tex)	flow ε_c %	breaking σ_r (cN/tex)	breaking ε_r %	The specific deforming mechanical work, *Lms* (cN/tex)
Melana II-P_2									
– non-fixed	214.9	29.79	7.52	3.95	10.14	13.75	17.10	26.04	4.97
– fixed	203.4	16.69	6.02	3.77	7.97	14.31	14.78	36.07	5.77
Melana II-P_5^+									
– non-fixed	264.8	39.19	7.83	4.22	11.64	13.94	18.78	24.5	5.33
– fixed	256.8	26.45	6.15	3.16	8.93	13.67	16.33	30.95	6.60
Melana III									
– non-fixed	298.5	45.61	8.84	3.30	13.26	12.99	22.24	24.0	6.30
– fixed	278.8	28.59	7.11	3.07	10.41	14.61	17.27	29.31	6.40
Melana IV									
– non-fixed	269.8	33.85	6.88	3.15	10.74	14.55	16.95	26.78	5.2
– fixed	238.3	25.63	6.07	3.22	8.9	14.26	16.7	30.9	6.3

Obs.$^+$– Melama II-P_5 represents the cable obtained on the technological line II, with a polymer obtained on line V

– Non-fixed and fixed, it refers to the cable curled with and without thermofixations

point of view, the samples obtained on lines II-P_5, III and IV have been thermofixed under a higher tension, as compared with the sample obtained on line II-P_2.

2.2. Static wearing through creep. The process of wearing through creep has been developed by the method of stressing the individual fiber with three forces (established from the effort-elongation curves) corresponding to the elastic and viscoelastic domain for three different stress durations: 1, 5 and 10 minutes. In all cases, the recurrence phenomenon has been followed for 10 minutes. The values of elasticity degree (G_e) and of the remanent deformation (ε_3) has been calculated under these conditions (Table 2).

Analysis of the average values given in Table 2 evidences the fact that, increasing the force and duration of the stress, the capacity of elastic recurrence decreases, while remanent deformation increases correspondingly. Such decreases of the elasticity degree are explained through the modifications intervening in the molecular and morphological structure of the fiber, as a consequence of breaking of some interaction forces or even of some chemical links, more intensely stressed, which induces modification of some initial reciprocal positions, accompanied by corresponding shifts of some chain segments.

The experimental data obtained clearly show that the fixation process of fibers favours elastic mobility and thus, reversibility, accompanied by diminishing of the remanent compound. At the same time, an improved elastic behaviour of the fixed fibers, as compared with the nonfixed ones, is due, too, to the fact that, by the

Table 2
"Creep-recurrence" characteristics

The technological line (sample)	P_s cN/fb	1			2			3		
	t_s (min)	1	5	10	1	5	10	1	5	10
Melana II-P_2										
non-fixed	G_e(%)	80.35	78.18	67.13	69.55	60.00	50.74	57.95	50.73	40.39
	ε_3(%)	19.64	25.80	32.85	30.43	40.00	49.24	42.04	49.26	59.60
fixed	G_e(%)	84.00	81.48	77.41	72.28	68.71	63.68	60.68	56.00	40.73
	ε_3(%)	16.00	18.51	22.58	27.71	31.06	36.28	39.30	44.00	59.25
Melana II-P_5										
non-fixed	G_e(%)	81.94	77.72	70.58	68.74	60.00	56.51	60.78	54.33	45.25
	ε_3(%)	18.06	22.28	29.41	31.25	40.00	43.47	39.21	45.66	34.75
fixed	G_e(%)	85.00	82.16	78.66	74.24	67.90	61.22	70.12	61.38	54.54
	ε_3(%)	15.00	17.84	21.34	25.75	32.00	38.71	29.88	38.61	45.45
Melana III										
non-fixed	G_e(%)	82.18	79.36	76.08	74.14	68.85	61.42	68.91	60.86	56.52
	ε_3(%)	17.82	20.64	23.92	25.86	31.15	38.57	31.08	39.13	43.47
fixed	G_e(%)	87.12	84.36	81.28	78.12	73.81	69.56	70.90	67.73	64.27
	ε_3(%)	12.88	15.64	18.72	21.87	26.19	30.43	29.09	32.25	35.71
Melana IV										
non-fixed	G_e(%)	72.00	67.18	61.95	67.04	60.74	55.03	59.15	52.97	42.85
	ε_3(%)	28.00	32.81	38.05	32.96	39.25	44.96	40.85	45.40	57.14
fixed	G_e(%)	80.00	76.88	73.88	72.72	68.33	62.50	70.50	67.44	61.10
	ε_3(%)	20.00	25.36	26.12	27.29	31.66	37.50	29.48	32.55	38.88

hydrothermal fixation treatment, a more compact, less porous structure of the fiber is also obtained.

On following the variation of the elasticity degree of the fibers obtained on various technological lines, the observation is also made that, on the Melana II line, no significant differences for the two polymers (P_2 and P_5) processed on this line, do exist. The fibers obtained on the Melana III line are, qualitatively, higer to all other lines.

3. Conclusion. Through analysis of the mechano-rheological behaviour of the Melana fibers obtained on various technological lines evidences their qualitative aspects. Depending on them, various technological steps may be taken for improving the fibers structure, in parallel with establishing the conditions of mechanical stress during textile processing, aiming at preserving, to a greatest extent, the elastic properties, and at reducing, as much as possible, remanent deformations.

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CARACTERIZAREA MECANO-REOLOGICĂ A UNOR SORTIMENTE DE FIBRE MELANA OBŢINUTE PRIN DIFERITE TEHNOLOGII PARTEA a II-a

(Rezumat)

Sînt prezentate rezultatele cercetărilor privind proprietăţile mecanice şi reologice ale unor sortimente de fibre Melana obţinute prin diferite tehnologii, pe trei linii tehnologice la CFS Săvineşti.

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RECHERCHES SUR LA STRUCTURE ET LES PROPRIÉTÉS DE CERTAINS FILÉS OBTENUS DE DIFFÉRENTS TYPES DE GRANULES EN POLYESTER

PAR

JULIETA HOMUTESCU, V. BLAŞCU et IRINA TĂRĂBOANŢĂ

1. Introduction. Grâce aux propriétés spécifiques des fils synthétiques texturés et surtout en polyesteres, grâce à l'extension des domaines de leur utilisation dans l'industrie textile, il y a dans le mode et chez nous des préoccupations concernant l'accroissement de la productivité et de diminution de la duree du processus technologique l'amélioration des propriétés de ces fils.

L'utilisation de grandes vitesses de filage lorsqu'on réalise l'orientation partielle ou totale des cathènes macromoléculaires (fils POY ou FDY) suivie de l'utilisation de la technologie d'étirage-texturage, a une influence favorable sur les propriétés des fils réalisés.

L'utilisation des fils type POY qui détermine l'obtention des fils d'une haute qualité a enregistré une grande extension à condition que tous les paramètres de travail de ce processus soient dirigés en conformité [1-6].

2. Méthodologie de recherche. Il y a quelques facteurs qui interviennent pendant les processus de filage, qui influencent simultanément et mettent leur empreinte sur la structure et la qualité des fils de filament dont dépend le comportement ultérieur pendant le texturage et donc les propriétés finales des fils texturés produits. Ces facteurs d'une grande importance pour le déroulement du processus de filage sont (1-3):

- la haute qualité et l'uniformité du polymère;
- les paramètres de la machine à filer réglés en conformité;
- un haut standard de mise au point et de fonctionnement de la machine.

En prenant en considération les conditions ennumérées cidessus, on peut assurer un degré élevé d'uniformité en longueur du fil filé mais aussi d'un fil à l'autre.

Lorsqu'on cherche les causes de l'apparition des irrégularités des filaments en filage il faut tenir compte de l'influence provoquée par la matiere polymérique, des variations de température de la fonte et de la filière, des conditions de réfrigération,

vitesse de filage etc. Les variations de structure, induites dans les filés, de déviations de ces paramètres des valeurs établies, peuvent être mises en évidence par une série d'analyses sensibles telles que: la valeur Uster, biréfrigence, la contraction à l'ébullition.

Dans la partie expérimentale de l'étude on a étudié les propriétés structurales des en polyesters filés, auxquels on a constaté dans la fabrication ultérieure, après l'étape d'étirage-texturage des défauts visibles. On a analysé l'assortiment de fils 76/34 dtex réalsés à partir de granules de deux provenances (type I et type II) qui ont les propriétés suivantes:

	type I	type II
viscosité intrinsèque	0,664-0,669	0,653
température de fonte °C	261,9-262,8	262
groupes – COOH	18-22	21,82
force de cisaillement	48-54	67

On a réalisé l'obtention des fils filés sur la même machine à filer vérifiée avec les parametres de fonctionnement parfaitement contrôlés et identiques, la vitesse d'enroulement pour les deux types de granules de 3025 m/min, la seule différence se réfère a la valeur de la temperature de filage sur la poutre (de 281-285°C au type I de granules et 274-278°C au type II).

3. Résultats et intérprétations. Pour la caractérisation, on a envisagé les formats obtenus sur les mêmes points de filage, le point 6 et le point 25; ceux – ci ont été testés par des déterminations de la contraction et les paramètres de courbes effort-déformation (fig.1), les valeurs moyennes sont inscrites dans le tableau 1.

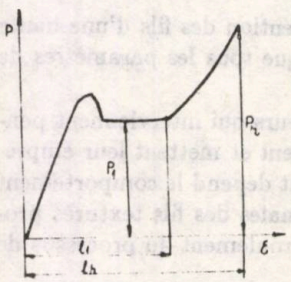

Fig. 1.– Courbe effort-déformation

On a constaté des valeurs individuelles de la contraction (qui ne figurent pas dans le tableau) pour les formats obtenus à partir des granules type I une uniformité structurale plus élevée à l'intérieur de chaque bobine (différences de max. 2,5% entre déterminations individuelles, par rapport des différences jusque 7% aux fils obtenus de granules type II).

À partir tableau 1, on observe que les valeurs moyennes de la contraction sont un peu plus élevées pour les formats obtenus sur le point 6 de filage pour les deux types de granules.

La dimension l_1, résultée de la courbe effort-déformation (fig.1) qui caractérise le niveau moyen de la préorientation du fil, présente de même des valeurs plus élevées pour les bobines réalisés sur le même point; la tendance est plus accentuée dans le cas des granules type II les valeurs obtenues étant en concordance avec celles de la contraction.

Les valeurs des paramètres mécaniques de rupture résultées des courbes sont presque les mêmes pour tous les formats testés, avec l'observation que les bobines de type II de granules filées sur le point 6 présentent un effort de développement de l_1 (P_1 et σ) plus grande et des valeurs plus élevées pour l'allongement de rupture

Tableau 1

Caractéristiques physiques – fil filé 76/34 dtex

Type granule	Post filage	Contract. moyenne C [%]	Densité linéaire [dtex]	p_1 [cN/fil]	σ_1 [cN/dtex]	l_1 [%]	p_2 [cN/fil]	σ_2 [cN/dtex]	l_2 [%]
I	25A	59,80	125,90	68,40	0,543	42,24	263,2	2,09	115,30
	25B	58,24	125,54	65,15	0,518	41,80	284,9	2,26	121,94
	25C*	56,86	126,37	66,20	0,524	39,43	261,1	2,066	111,50
	6A*	59,66	126,38	67,00	0,530	42,35	273,6	2,164	117,30
	6B	61,82	125,77	64,92	0,516	40,26	278,8	2,216	115,20
	6C	62,02	125,63	66,10	0,526	42,32	275,7	2,194	122,35
II	25A*	58,04	127,47	66,80	0,524	41,20	274,2	2,151	120,56
	25B	58,18	128,24	64,28	0,501	41,67	264,09	2,059	116,60
	25C*	63,08	128,09	66,80	0,521	42,73	254,2	1,984	117,46
	6A*	62,54	127,61	70,00	0,548	48,40	266,8	2,09	124,20
	6B	63,96	127,78	69,77	0,546	47,82	264,92	2,073	124,86
	6C*	64,72	128,20	71,40	0,556	46,99	265,7	2,072	125,10

(l_r).

Pour saisir les différences structurales qui existent sur les fils de certains formats on a effectué des déterminations de densité par la méthode de gradient, température de mouillage et de biréfrigence, les valeurs étant inscrites dans le tableau 2, et analyses de microscopie électronique de balayage (fig.2-5).

Tableau 2

Caractéristiques structurales – fil filé 76/34 dtex

Type granule	Post filage	ρ [g/cm^3]	Temp. mouillage [°C]		Temp. fonte [°C]		Birefrig. [$\Delta n \cdot 10^{-3}$]	
			Valeurs individuelles	Valeur moyenne	Valeurs individuelles	Valeur moyenne	Valeurs individuelles	Valeur moyenne
I	25C	1,3830	255; 255; 253 256; 257; 255	255,2	259; 261; 258 261; 262; 260	260,2	44,39; 42,45; 43,05; 44,39; 45,83	44,02
II	25C	1,3840	251; 253; 250; 261; 265; 258; 257; 251	255,75	256; 257; 256; 265; 270; 263; 262; 256	260,63	48,6; 45,41; 48,16; 46,75; 49,39	47,7
	25A	1,3825	249; 250; 252; 252; 249; 250	250,4	254; 255; 258; 259; 254; 256	256,0	45,8; 45,05; 42,4; 43,75; 45,10; 44,0	65,8
I	6A	1,3876	256; 257; 256; 253; 257; 255	255,8	260; 261; 260; 259; 262; 260	260,6	86,5; 111,5; 47,35; 46,9; 46,4; 56,36	65,8
II	6A	1,3815	250; 249; 251; 249; 249;	249,7	255; 256; 258; 255; 256;	256,0	48,4; 48,09; 49,4 48,8; 47,4;	48,42
	6C	1,3834	253; 253; 252; 250; 252;	252,0	259; 259; 255; 254; 257;	257,2	46,04; 71,30; 41,19 73,0; 44,8; 41,7	53,0

Fig. 2.– Fil 25C granule I (Mt = 500)

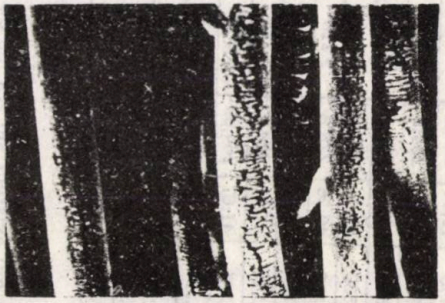

Fig. 3.– Fil 25A granule II (Mt = 500)

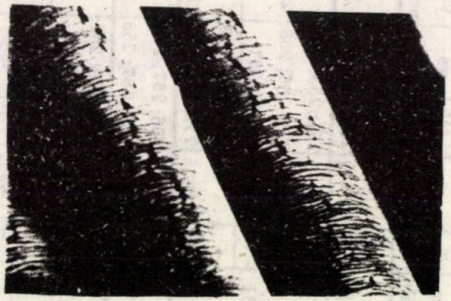

Fig. 4.– Fil 25C granule I (Mt = 2000)

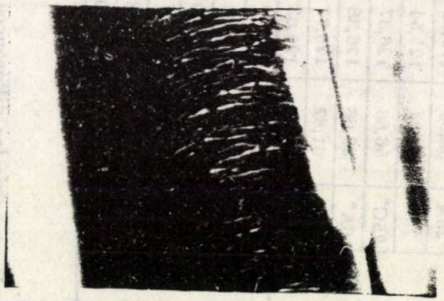

Fig. 5.– Fil 25A granule II (Mt = 2000)

En général, on constate que, les valeurs moyennes, on ne remarque pas de différences trop grandes entre les bobines concernant la température de mouillage et de fonte; à l'intérieur de certains formats (25°C le type de granules II) on peut remarquer des nonuniformités structurales qui se caractérisent par des différences allant jusqu'aux 14°C entre déterminations sur la ligne du même fil. On a constaté de telles non-uniformités des valeurs de biréfrigence, sur l'esemble, les formats filés sur le point 6 présentant en général une orientation structurale élevée.

Les analyses de microscopie électronique mettent en évidence les déficiences qualitatives similaires pour les fils obtenus des deux types de granules, c'est-à-dire: pliages superficiels de l'éncorce, de nombreuses fissures, grande densité d'oligomères sur la surface des fils.

4. Conclusions. On a caracterisé dans l'étude des fils en polyesthers réalisés à partir de deux types de granules, sur une même machine à filer.

On constate que, sans tenir compte du type de granules, les petites déviations possibles des paramètres de fonctionnement d'un point de filage à l'autre, ou sur le même point, déterminent des nonuniformités de structure étant possibles les influences dans la qualité des fils obtenus.

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CERCETĂRI ASUPRA STRUCTURII ŞI PROPRIETĂŢILOR UNOR FIRE FILATE OBŢINUTE DIN DIFERITE TIPURI DE GRANULE DE POLIESTER

(Rezumat)

Se prezintă factorii care influenţează structura şi proprietăţile la fire filate de tip poliesteric. La aceste fire realizate pe bază de două tipuri de granule au fost studiate proprietăţile fizice, mecanice şi structurale. Pe aceste căi au fost evidenţiate neuniformităţile structurale produse de mici deviaţii ale parametrilor tehnologici din filare.

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Secţia VIII
TEXTILE. PIELĂRIE

SOME POLYMER-ANALOGOUS REACTIONS ON CELLULOSIC FIBRES

BY

V. BLAŞCU and CRISTOFOR I. SIMIONESCU

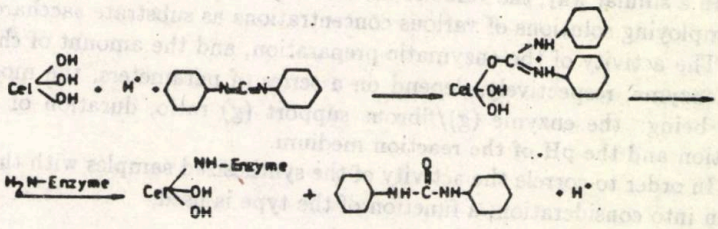
1. Introduction. Cellulosic fibers are mainly constituted of cellulose, containing in its structure 1,4-β-D-anhydroglucopiranose units; this macromolecular structure is common both to natural and artificial cellulose fibers. Cellulose elementary link contains 3 free hydroxylic groups, a primary one at C_6 and two secondary groups at C_2 and C_3, respectively; they differ among them as to their reactivity, the primary hydroxyl being about 6 times more reactive than the secondary ones. Cellulose chemical structure favoured the development of several chemical reactions on both natural and artificial fibers, either improving certain properties or favouring high finishes [1, 2].

The present study analyses some new analogous-polymer reactions on cellulosic fibers, namely immobilization of some enzymes.

2. Experimental. Enzymes insolubilization has multiple practical applications such as in biochemical analyses, medicine, technologies based on enzymatic reactions, etc. [3]. Thus, three general methods are known for enzyme immobilization: reticulation, encapsulation, binding on various supports (physical absorption, ionic or covalent binding).

We followed the immobilization of an enzyme belonging to the class of hydrolases, namely invertase, on natural fibrous polymers. The following enzyme-support systems have been selected for our study: invertase-cotton; invertase-viscose.

Immobilization of invertase on cellulosic supports has been catalyzed by dicyclohexylcarbodiimide, the reaction occurring, in a weakly acid medium according to the following mechanism:



The amount of invertase is dissolved, under stirring, in a volume of phosphate buffer with various pH values; then, an amount of 0.1 g fiber is introduced. Separately, the necessary amount of dicyclohexylcarbodiimide is dissolved in a volume of 1 ml tetrahydrofurane, which is added to the reaction mixture. The reaction mixture is kept, under stirring, at a temperature of 10±1°C. When the reaction is over, the sample is treated with a volume of 5 ml tetrahydrofurane, under stirring, for 15 minutes, for the removal of non-reacted dicyclohexylcarbodiimide and dicycohexylurea thus formed, then 15 ml acetona are added. The sample is then washed with a volume of 200 ml acetate buffer (pH = 4.5; 0.02 M) through centrifugation (4,000 rpm, for 7 min). In the end, it is washed with phosphate buffer, put into vials, and kept at a temperature of 4°C, until its activity is determined.

Invertase is an enzyme catalyzing the hydrolysis reaction:

$$\text{Saccharose} + \text{water} \rightarrow \text{glucose} + \text{fructose}$$

Analysis of the preparations activity has been made photocolorimetrically. First the reference curves have been established for 3 solutions of inverted sugar, having concentrations of 0.25, 0.025 and 0.0025 M. In 10 vials, 0, 0.1, 0.2, ..., 1 ml solution of inverted sugar and 1, 0.9, 0.8,..., 0 ml distilled water, respectively, have been introduced to saccharose solution (the concentration of which coresponded to the solution of inverted sugar) and 2 ml reactive – 3,5 dinitrosalicylic acid. Then, the samples have been incubated for 5 minutes in a vapour bath. After cooling, 10 ml of distilled water was added, colorimetry at 540 nm versus this liquid being performed. A reference sample is made, too, for each of the above products, in which the enzymatic reaction is stopped at time 0 by the introduction of 3,5 dinitrosalicylic acid before the enzymatic preparation. The reference curve correlates optical density with the amount of inverted sugar. Then, 0.1 g enzymatic preparation and 1 ml saccharose solution (in buffer 4.5) are incubated for 15 min at 37°C, then the enzymatic process is stopped by the addition of 2 ml 3,5-dinitrosalicylic acid and boiling on a vapour bath for 5 minutes. After cooling, the mixture is diluted at 10 ml and is colorimetered versus distilled water, at 540 nm.

The reference curve permits reading the number of μmoles of inverted sugar, corresponding to the optical density read on a FEK 56M photocolorimeter. The enzymatic activity is calculated with the following relation:

$$A = \frac{\mu\text{moles inverted sugar (sample)} - \mu\text{moles inverted sugar (reference sample)}}{15\ \text{min.weight of dry substance}}$$

In a similar way, the value of the M i c h a e l i s constant (K_M) is established, on employing solutions of various concentrations as substrate saccharose.

The activity of the enzymatic preparation, and the amount of chemically bound enzyme, respectively, depend on a series of parameters, the most important ones being: the enzyme (g)/fibrous support (g) ratio, duration of the coupling reaction and the pH of the reaction medium.

In order to correle the activity of the synthesized samples with the parameters taken into consideration, a function of the type is used:

$$Y = a_o + \sum a_i x_i + \sum a_{ij} x_i x_j \qquad i \leq j$$

where, Y – enzymatic activity;

x_i, x_j – variable representing the parameters taken into consideration;

a_o, a_i, a_{ij} – regression coefficients.

The regression coefficients have been calculated with a centrate, rotatory, compound second order program [4].

Tables 1 and 2 list the codification of the parameters taken into consideration.

Table 1

Codification of variables for invertase/cotton coupling

Real variable	Coded variable				
	−1.682	−1	0	1	1.682
x_1 – invertase/cotton (g/g)	0.8	1.9	2.4	3.6	4.8
x_2 – duration (h)	5	12	20	28	37
x_3 – pH	7	7.4	7.8	8	8.3

Table 2

Codification of variables for invertase/viscose coupling

Real variable	Coded variable				
	−1.682	−1	0	1	1.682
x_1 – invertase/viscose (g/g)	0.5	1	1.7	2.3	3.0
x_2 – duration (h)	3	9	16	24	33
x_3 – pH	7	7.1	7.4	7.6	7.8

The experimental planes chosen have no absolute maximum for either of the studied cases, the most favourable reaction conditions for attaining maximum activity being the following:

– fot the invertase/cotton system: Invertase/cotton = 4.5g/g; time = 34 hours; pH = 7.9;

– for the invertase/viscose system: Invertase/viscose = 2.2 g/g; time = 23 hours; pH = 7.5.

The experimental results obtained agree with literature data on the immobilization of some hydrolases on natural polymers [5, 6].

Viscose is found as more accessible for enzymatic coupling than cotton, due to its more amorphous supermolecular structure, as compared with cotton.

3. Conclusions. Enzymes from the class of hydrolazes may be immobilized on both natural and artificial cellulosic fibers.

Enzymes are biological catalysts of very high efficiency, made of proteic chains, whose action is manifested under normal pressure conditions, usually in neutral aqueous solutions. Conventionally, the reactions involving enzymes are developed by incubation, at a specific optimal temperature, of a solubilized substrate

and enzymes. There, nevertheless, appears a series of technical difficulties as to the enzyme removal from the reaction product, so that its denaturation is required. This solution is wholly non-economical because, as it does not permit the enzyme reutilization of the above-mentioned disavantages, we applied enzymatic immobilization on textile supports (cotton and viscose fibers).

Immobilization is performed through covalent bondings. Invertase insolubilization permits a series of practical applications in the technologies of sugar industrial fabrication.

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UNELE REACŢII POLIMER-ANALOAGE PE FIBRE CELULOZICE

(Rezumat)

În lucrare se analizează cuplarea de enzime pe fibre de bumbac şi viscoză şi influenţa acestor modificări asupra comportării fibrelor.

Sînt prezentate condiţiile optime de reacţie şi se analizează activitatea enzimatică a preparatelor obţinute.

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TEXTILE. PIELĂRIE

CERTAINS ASPECTS CONCERNANT L'INFLUENCE DE LA DUITAGE ET DE LA TENSION DE LA CHAÎNE AU TISSAGE SUR LES PROPRIÉTÉS TENSIONALES DE BASE DU TISSU

PAR

OLIMPIA MARCHIŞ, DORIN AVRAM et MARIA AVRAM

1. Introduction. Dans la réalisation de la structure du tissu intervient multiples facteurs d'influence de la structure et des conditions de travail; parmi ceux-ci un role prédominant l'ont la duitage et la tension de la chaîne. Les deux facteurs se conditionnent mutuellement, à savoir; l'augmentation de la duitage pour un réglage unique imposé initial de la tension, provoque l'accroissement de la tension de la chaîne et pour la duitage donnée, l'augmentation de la tension de la chaîne favorise l'obtention de tissu à un degré de compactité superieur dans la trame. Si on considére aussi l'irregularité de la finesse des fils de trame qui influence la tension de la chaîne par la résistance au debut du tissu par rapport au peigne, au entassement, on apprecie que au mètier à tisser apparaissent des conditions qui affectent les propriétés du tissu due au variations d'amplitude petite de la tension de la chaîne.

2. Partie experimentale. L'étude s'est proposé d'examiner le modèle dans lequel la tension de la chaîne pendant le tissage, comme principal parametre technologique aussi la duitage, la caractéristique structurale de base, qui influence l'intensité de l'anssemblage des fils dans la structure du tissu et donc les propriétés tensionales.

Pour l'étude on a choisi l'article 294-05-6 aux caractéristiques structurales présentées dans le tableau 1.

Conformémement à cettes caractéristiques, en utilisant le grafique de la duitage géométrique minimum, on a considéré que l'article 294-105-6 équilibré d'apres la finesse et àux duitages géométriques sous-critiques pour les deux systèmes, le domaine de stabilisation de la structure s'inscrit approximativement entre les phases V et VI avec une tendance d'augmentation de l'ondulation des fils de chaîne.

L'augmentation de la duitage technologique dans la trame jusqu'à une certaine limite imposée par la rigidité à la courbure de la chaîne tend situer le tissu vers une phase structurale inférieure.

Tableau 1

No.	Caractéristiques		Valeurs
1	composition fibreux	chaîne trame	60% PES + 40% fibranne
2	finesse (Nm)	Nm_u Nm_b	$43/2(d_{ch}=d_t\ 0{,}272)$
3	comptes duits	P_u P_b	270 fils/locm 220 duits/locm
4	l'armure		D 2/2

– Nm_u – finesse de la chaîne;
– Nm_b – finesse de la trame.

L'augmentation de la tension de la chaîne spécialement dans le cas de l'armure équilibrée à la finesse, tend aussi deplaser la phase de structure autour et sous la phase de l'équilibre de V.

On réalise de cette façon, aux variantes qui cumulent l'influence de l'augmentation de la duitage et de la tension de la chaîne, un effect d'empaquetage serré pour les deux systèmes de fils, ce qui affectent les propriétés phisiques du tissu.

L'action cumulée de la tension de la chaîne et de la duitage bien quéelle est décisive pour les conditions de la formation de l'armure et les proprétés du tissu, due à la rélation entre les deux facteurs, ne peut pas étudiée par la méthode du modelage mathématique sur la base de la planification des expériances. Par concéquence, dans la recherche on a adopté le programme classique de variation de degré en degré, donné par les limites technologiques.

On a utilisé dans le programme trois niveaux de duitage en utilisant la même chaîne et trois niveaux successifs pour la tension.

Le tissage a été efectué sur un mètier à tisser IMATEX L_5 et les essais sur le tissu écru ont été testés dans le laboratoire.

Les valeurs moyennes des rézultats sont présentées dans le tableau no.2, qui contient aussi les valeurs de la tension utilisée pour chaque variante.

En appliquant la méthode d'interpolation par les polynômes, utilisée couramment quand la fonction est définie par un tableau de valeurs qui représentent les résultats experimentaux, on a obtenu deux séries (A,B) d'équations qui expriment la variation de la résistance à la rupture et de l'allongement à la rupture du tissu en direction de la chaîne, en fonction de tension de la chaîne, pour le niveau donné de la duitage et la variation des mêmes propriétés tensionales en fonction de la duitage-pour la tension en chaîne pendant le tissage imposée aux trois niveaux.

Les descriptions analytiques obtenues sur la base des données du tableau no.2 sont ainsi groupées:

Série A $S_{Ru} = f(T_u)$ pour P_b=const.
$\lambda_{Ru} = f(T_u)$
Série B $S_{Ru} = f(P_b)$ pour T_u=const.
$\lambda_{Ru} = f(P_b)$

Tableau 2

No.	Les variations de la duitage (fils/locm)	La tension de la chaine au tissage (cN/fil)	La modification de la tension entre les variants par rapport à la moyenne (%)	La résistance à la rupture S_{Ru} (daN)	L'allongement à la rupture du tissu λ_{Ru} (mm)	La modification de S_{Ru} et λ_{Ru} par rapport à la moyenne (%)	
						S_{Ru}	λ_{Ru}
1	208	291,50	–4,2	67	23	–31	–17,7
2		304,64	–	97	28	–	–
3		331,35	9	104	25	7,2	10,7
4	224 M $\|P_u$ =270 $\|P_b$ =220	296,50	–4,2	70	28	–31,3	12
5		309,64	–	102	25	–	–
6		336,35	8,6	105	22	2,9	–12
7	236	301,50	–5,6	77	27	–2,8	12,5
8		319,64	–	107	24	–	–
9		341,35	6,8	112	21	4,7	–13

En utilisant la méthodologie spécifique de calcul on a obtenu les équations du tableau 3 et leur représentation dans les figures 1...4.

Tableau 3

No.	Série	Conditions imposées	Equation	Coordonnées extrêmes de la fonction	
				x	y
1	A $S_{Ru} = f(T_u)$ P_b =ct	P_b =208	y =–0,05240x^2+33,62x–5281,60	320,8	113 M
2		P_b =224	y =–0,05810x^2+37,64x–5962,55	323,9	114,1
3		P_b =236	y =–0,03568x^2+23,81x–3860,73	333,7	114,16
4	B $S_{Ru} = f(P_b)$ T_u ≃ct	T_u ≃296cN	y =0,01412x^2–5,91x+686,11	209,5	66,97 M
5		T_u ≃311,2	y =0,00372x^2–1,294x+205,35	173,9	92,8
6		T_u ≃336,3	y =0,01860x^2–7,973x+957,61	214,3	103,2
7	A $\lambda_{Ru} = f(T_u)$ P_b =ct	P_b =208	y =0,00304x^2–2,048x+367,88	336,9	22,81 M
8		P_b =224	y =0,00290x^2–1,989x+362,35	342,3	21,89
9		P_b =236	y =0,00066x^2–0,579x+141,12	434,11	15,27
10	B $\lambda_{Ru} = f(P_b)$ T_u ≃ct	T_u ≃296cN	y =0,00074x^2–0,4007x+80,26	270,15	26,13
11		T_u ≃311,2	y =0,0007416x^2–0,4007x+77,26	270,159	23,13
12		T_u ≃336,3	y =0,0007416x^2–0,4007x+74,2	270,15	20,13

On a calculé les valeurs des tangentes à la courbe pour pouvoir sélectionner le facteur d'influence prédominant dans les quatre cas analysés. Dans le tableau 4 sont groupées les valeurs numériques obtenues pour chaque type de rélation.

Dès les données du tableau 4 on apprécie par la valeur tgα, respectivement la pente de la tangente à la courbe, l'intensité de l'influence du paramètre respectif dans le processus.

On constate qu'autant pour la résistance à la rupture que pour l'allongement

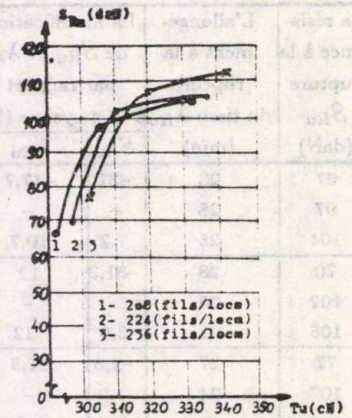

Fig. 1.– Le graphique de la variation $S_{Ru} = f(T_u)$, pour P_b=const.

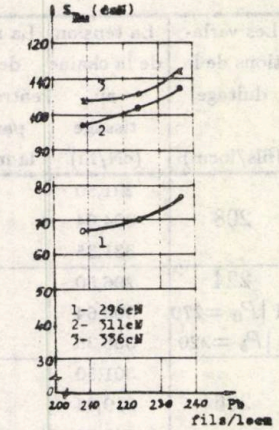

Fig. 2.– Le graphique de la variation $S_{Ru} = f(P_b)$, pour $T_u \approx$ const.

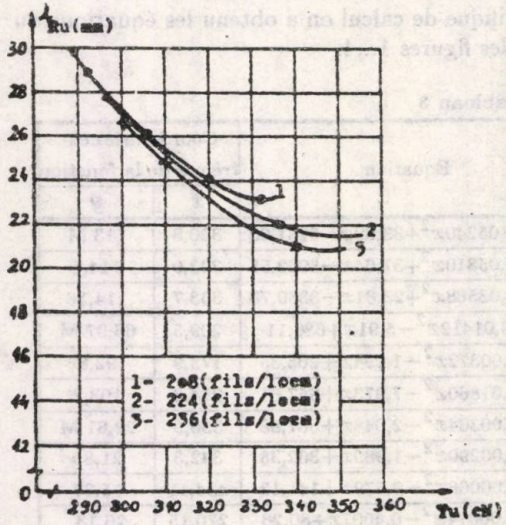

Fig. 3.– Le graphique de la variation $\lambda_{Ru} = f(T_u)$, pour P_b=const.

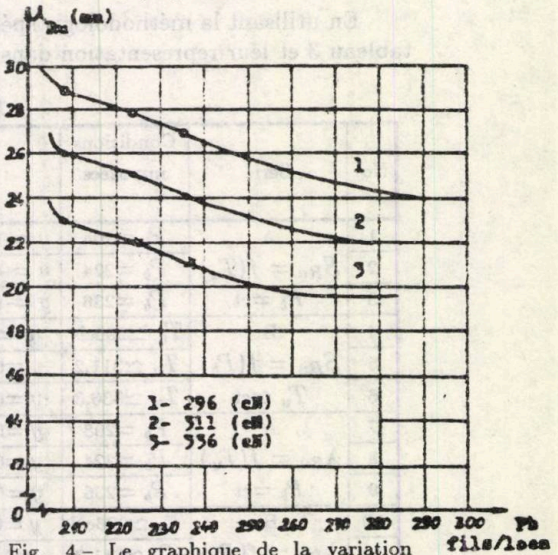

Fig. 4.– Le graphique de la variation $\lambda_{Ru} = f(P_b)$, pour $T_u \approx$ const.

à la rupture du tissu l'influence prédominante appartient à la duitage, par rapport à la tension de la chaîne.

Les données du tableau ont été utilisés dans la représentation de l'espace dans la fig.5 d'où on peut suivre la variation de la résistance à la rupture et le l'allongement à la rupture pour quoi qu'il en soit la paire de valeurs de la duitage et de la tension de la chaîne au tissage.

A partir de données inscrites dans les tableaux 2,4 et figure 5, on observe les suivants:

Tableau 4

No.	Série	Function, conditions	tgα
1	A	$S_{Ru} = f(T_u)$ $\begin{cases} P_{b1} = 208 \\ P_{b2} = 224 \\ P_{b3} = 236 \end{cases}$	0,45
2			0,75
3			0,35
4		$S_{Ru} = f(P_b)$ $\begin{cases} T_{u1} = 296 \\ T_{u2} = 311,2 \\ T_{u3} = 336,3 \end{cases}$	0,55
5			0,50
6			0,35
7	B	$\lambda_u = f(T_u)$ $\begin{cases} P_{b1} = 208 \\ P_{b2} = 224 \\ P_{b3} = 236 \end{cases}$	1,2
8			0,7
9			0,6
10		$\lambda_{Ru} = f(P_b)$ $\begin{cases} T_{u1} = 296 \\ T_{u2} = 311,2 \\ T_{u3} = 336,3 \end{cases}$	0,4
11			0,35
12			0,3

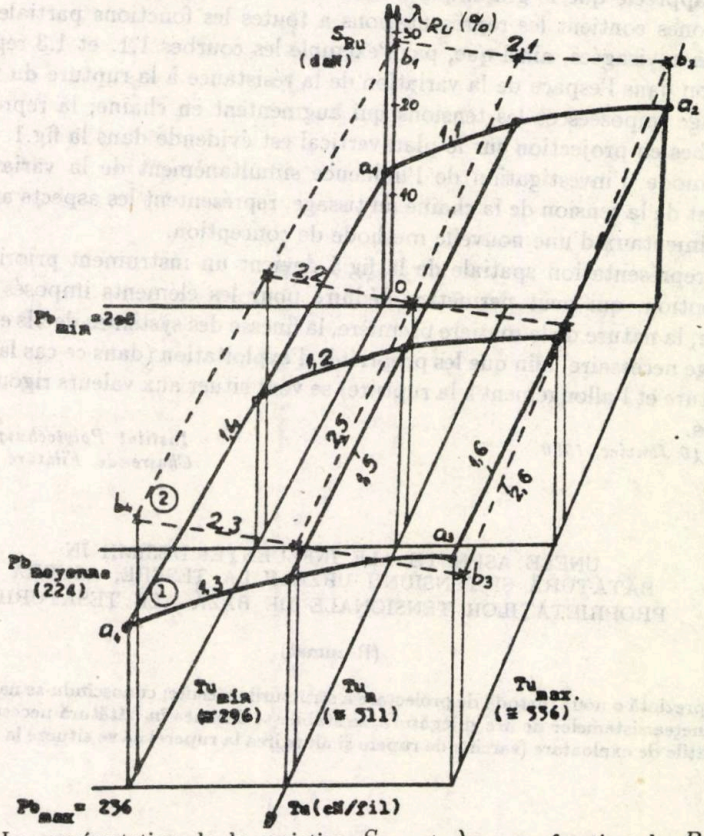

Fig. 5.– La représentation de la variation S_{Ru} et λ_{Ru} en fonction de P_b et T_u.

– dans le domaine des duitages minimes utilisées dans le programme, l'augmen-

tation de la tension de la chaîne pendant le tissage, provoque des modifications intense specialement à l'allongement, le phénomène pouvant être expliqué par la mobilité plus prononcée de la trame et de la chaîne;

– la position rélative des plans $S_{Ru}(1)$ et $\lambda_{Ru}(2)$ dans la représentation de la fig.5, met en évidance la tendance compensatrice pour les deux propriétés, specialement dans le domaine des tensions petites en chaîne au tissage. Plus augmente la tension de la chaîne au tissage, même pour la duitage moyenne, on obtien une armure stable avec une capacité plus petite de déformation. Dans la zone $a_3 - b_3$ les plans qui représentent la variation pour les deux propriétés du tissu sont presque superposés et dans les conditions respectives de travail du tissu on attend l'obtention d'une armure compacte, stable, très résistante aux efforts à l'extention, à une réduction évidante de la capacité de déformation.

On apprecie que le graphique d'enssemble de la fig.5 c'est une synthèse auxquelles zones contient les représentations a toutes les fonctions partiales avec les influences envisagées, ainsi que, par l'exemple les courbes 1.1. et 1.3 représentent la position dans l'espace de la variation de la résistance à la rupture du tissu pour les duitage imposées et les tensions qui augmentent en chaîne; la représentation des courbes en projection sur le plan vertical est évidende dans la fig.1.

Le mode d'investigation de l'influence simultanèment de la variation de la duitage et de la tension de la chaîne au tissage, représentent les aspects analytiques et expérimentaux d'une nouvelle methode de conception.

La représentation spatiale de la fig.5 devient un instrument prioritaire dans la conception, qui peut permettre déduire pour les éléments imposés en ce qui concerne; la nature de la matiere première, la finesse des systèmes de fils et l'armure, la duitage necessaire, afin que les propriétés d'exploitation (dans ce cas la résistance à la rupture et l'allongement à la rupture) se vont situer aux valeurs rigoureusement imposées.

Reçue le 10 Janvier, 1990

Institut Polytechnique, Jassy,
Chaire de Filature et Tissage

UNELE ASPECTE ALE INFLUENŢEI DESIMII ÎN BĂTĂTURĂ ŞI TENSIUNII URZELII LA ŢESERE, ASUPRA PROPRIETĂŢILOR TENSIONALE DE BAZĂ ALE ŢESĂTURII

(Rezumat)

Se prezintă o nouă metodă de proiectare a structurilor ţesute; cunoscîndu-se natura materiei prime, fineţea sistemelor de fire şi legătura, se stabileşte desimea în bătătură necesară pentru ca proprietăţile de exploatare (sarcina de rupere şi alungirea la rupere) să se situeze la valori riguros impuse.

BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
Tomul XXXVII (XLI), Fasc. 1–4, 1991
Secţia VIII
TEXTILE. PIELĂRIE

RESEARCH WORK ON THE BEHAVIOUR OF GEOTEXTILES UNDER COMPRESSIVE STRAIN

BY

CONSTANTIN PREDA, MARIA ZAMFIR,
CORINA RĂŞINĂ and CONSTANŢA AVĂDANEI

1. Introduction. There is a world-wide trend toward the growth of geotextiles production, from about 250.000.000 sq·m/year in 1985 the increase is projected for 500.000.000 sq·m/year by 1990.The nonwovens with synthetic fibres are among the geotextile types primarily used in geotechnical engineering and land reclamation.As a result of the production growth of nonwoven textiles that can be utilized as geotextiles, considerable research and investigation time have been invested into determining the characteristics that meet the requirements related to stress and strain during application.

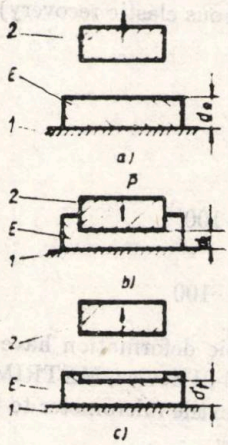

Fig. 1

Compression is one of the main strains geotextiles used in hydrotechnics and land improvement have to undergo.

A synthesis of the research done in order to study nonwoven textiles utilized as geotextiles under compressive forces is shown in the paper; many testing methods have been created for the purpose.

2. Results of Research. The test bar of a geotextile material E was considered with the test bar d_0 (Fig.1-a), and placed on the plane surface *1*, and on it can act disk *2* that is able to stress under compression so that a change in thickness appears function of the magnitude of the deformation force $\overline{P}$ and its duration.

The testing can be done in two stages corresponding to the deformation in a pul-set time (Fig.1-b) and to the relaxation when deformation load is removed, a different span of time (Fig.1-c).

The variation of the material thickness d function of time t when the material has been stressed at static compression under the deformation load $\overline{P}$ and after removing it is shown in Fig.2.

The values of the thickness marked on the diagram in Fig.2 shown the to-

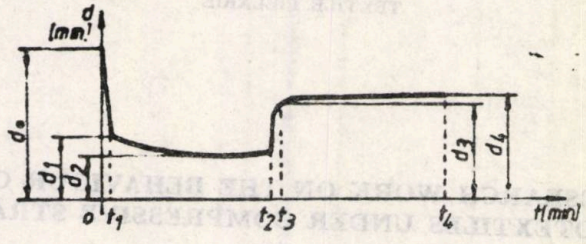

Fig. 2

tal deformation ε_t and its components: instantaneous deformation ε_{t_1} and shown deformation ε_{t_2}.

$$\varepsilon_t = \frac{d_o - d_2}{d_o} \cdot 100 = \varepsilon_{t_1} + \varepsilon_{t_2},$$

can be written:

$$\varepsilon_{t_1} = \frac{d_o - d_1}{d_o} \cdot 100 \quad \text{and} \quad \varepsilon_{t_2} = \frac{d_1 - d_2}{d_o} \cdot 100.$$

When the deformation load $\overline{P}$ is removed, a relaxation process takes place during the time interval $t_4 - t_2$, marked by the plastic deformation ε_p and the elastic recovery ε_e, with their components ε_{e_1} (instantaneous elastic recovery) and ε_{e_2} (slow elastic recovery).

$$\varepsilon_t = \varepsilon_p + \varepsilon_e = \varepsilon_p + \varepsilon_{e_1} + \varepsilon_{e_2},$$

can be written:

$$\varepsilon_p = \frac{d_o - d_4}{d_o} \cdot 100; \quad \varepsilon_e = \frac{d_4 - d_2}{d_o} \cdot 100$$

$$\varepsilon_{e_1} = \frac{d_3 - d_2}{d_o} \cdot 100; \quad \varepsilon_{e_2} = \frac{d_4 - d_3}{d_o} \cdot 100$$

Two methods of testing the geotextiles under static deformation have been designed; they are based on the utilization of the type FC-01 device, METRIMPEX – having devices to modify the deformation load and a textile micrometer to follow up the variation in thickness of the material under study.

The contact surface between the deformation disk and the test bar was 11.636 sq·cm. The testing time for each sample was 40 minutes, 20 minutes for deformation and 20 minutes for relaxation. The two established testing methods differ function of the magnitudes of the deformation loads and the way of using them.

The first method implies the utilization of a deformation load of 5 daN.The second method implies the successive application over a 5 minutes period of progressive loads of 5daN, 10daN, 15daN and 20daN from the moment of contact with

deformation disk and, then, minute by minute.In some of the cases the loads acting on the geotextiles recur at time intervals, with a very short period of action.

Taking into account the test bar of geotextile material E placed on the fixed plane surface *1*, with an initial thickness d_o, under the action of the deformation head *2*, compressive strains appear at equal intervals of time, under constant load, which make possible the continuous reducing of the growth up to a value d_t (Fig.3).

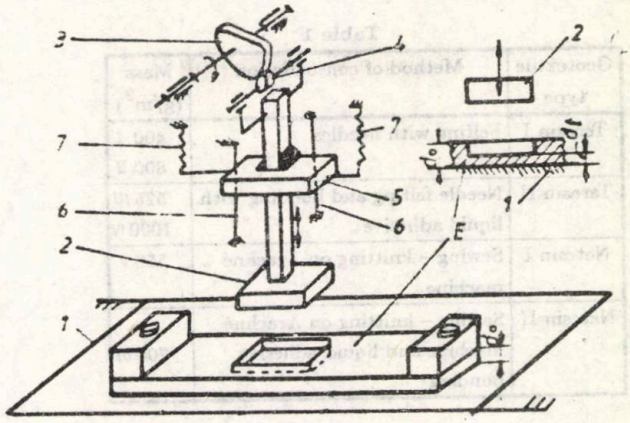

Fig. 3

The prototype of a device for which the contact surface between the deformation head and the test bar is of 50 sq·cm, was designed.The deformation head is operated by a mechanism with cam *3*, roller *4*, link block *5*, and fixed link blocks *6* (Fig.3).The contact between cam *3* and roller *4* is achieved by mens of springs *7*.

The deformation head is able to carry out 20 cycles/minute, and the testing time was 15 minutes. By means of a disk micrometer DM-100 the values of the test bar thickness can be determined before the load is applied (d_o), after 15 minutes of compressive cyclic strains (d_t) and after 24 hours relaxation (d_r).

The corresponding values for the total deformation ε_t and its constituents, the elastic recovery ε_e and plastic deformation ε_p.

$$\varepsilon_t = \varepsilon_e + \varepsilon_p = \frac{d_o - d_t}{d_o} \cdot 100,$$

can be written:

$$\varepsilon_e = \frac{d_r - d_t}{d_o} \cdot 100 \quad \text{and} \quad \varepsilon_p = \frac{d_o - d_r}{d_o} \cdot 100.$$

The testings have been done with nonwoven TERASIN and NETESIN type textiles from 100% synthetic fibres recovered by unweaving waste products resulted from cutting ont the stockinets (knitwear).

The fibre (filaments) layers have been obtained by carding – folding, and bonding was done mechanically (through felting with needles or sewing – knitting)

and mixed mechanically and chemically, by impregnating the consolidated products through felting with needles or sewing – knitting in adhesive Romacril type solution. Types of tested geotextiles with different mass weights ou surface unit and different ways of consolidation are shown in Table 1.

Table 1

Geotextile type	Method of consolidation	Mass (g/m^2)
Terasin I	Felting with needles	400 *I* 800 *II*
Terasin II	Needle felting and bonding with liquid adhesive	525 *III* 1000 *IV*
Netesin I	Sewing – knitting on Arachné machine	550 *V*
Netesin II	Sewing – knitting on Arachné machine and liquid adhesive bonding	700 *VI*

The diagrams of variation in thickness of geotextiles during the static stress on compression and when the deformation load is removed, using the testing methods with a constant deformation force are shown in Fig.4 and Fig.5.

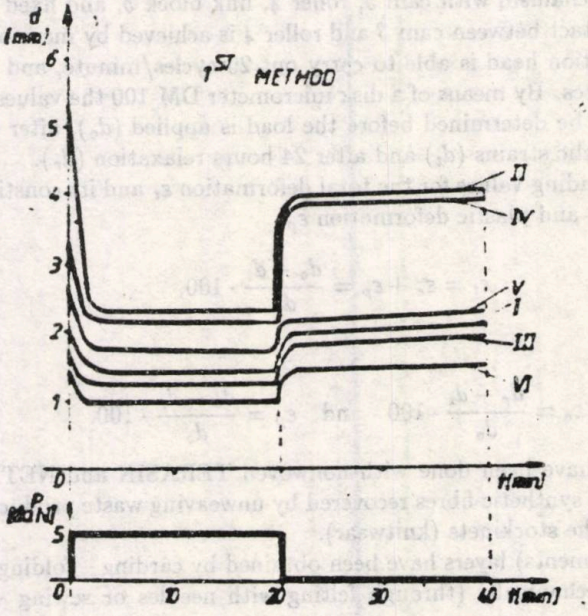

Fig. 4

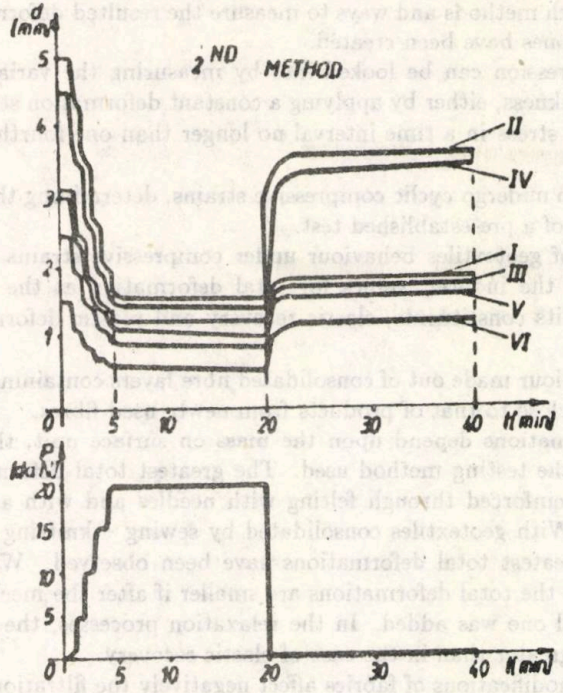

Fig. 5

The total deformation ε_t, the elastic recovery ε_e and the plastic deformation ε_p were calculated on the basis of the messurements noted on diagrams in Fig.4 and Fig.5, for the first and the second method

The calculated values for ε_t, ε_e and ε_p either in static stress on compression or in repeated compressive strains are summed up in Table 2.

Table 2

Geotextile type	Mass variants (g/m^2)	Static compression						Repeated compressive strain		
		1^{st} method			2^{nd} method			3^{nd} method		
		ε_t (%)	ε_e (%)	ε_p (%)	ε_t (%)	ε_e (%)	ε_p (%)	ε_t (%)	ε_e (%)	ε_p (%)
Terasin I	400	51.34	15.77	35.77	69.47	25.55	43.92	21.95	8.36	13.62
	800	63.27	22.61	40.66	79.74	38.78	37.96	25.00	6.01	18.99
Terasin II	525	50.12	19.51	30.61	69.06	28.34	40.72	14.66	7.20	7.46
	1000	60.24	19.88	40.36	74.75	22.89	51.86	15.11	5.01	10.10
Netesin I	550	32.11	13.01	19.10	56.10	27.85	28.35	8.85	1.70	7.15
Netesin II	700	30.71	12.85	17.86	50.69	26.86	23.83	4.83	1.93	2.90

3. Conclusion. As a result of research done, the following conclusion are reached:

– The compressive strains which geotextiles undergo can be reproduced by

laboratory tests for which methods and ways to measure the resulted deformations comparable to the real ones have been created.

– The static compression can be looked into by measuring the variation in time of the material thickness, either by applying a constant deformation stress, or by applying progressive stress in a time interval no longer than one fourth of the deformation time.

Geotextiles can also undergo cyclic compressive strains, determining the total deformation at the end of a pre-established test.

– The estimation of geotextiles behaviour under compressive strains can be carried out function of the induced values for total deformation at the end of compressive strain and its constituents, elastic recovery and plastic deformation, after relaxation.

– Geotextiles behaviour made out of consolidated fibre layers containing fibres from waste products is close to that of products from newly used fibres.

– Registered deformations depend upon the mass on surface unit, the consolidation process and the testing method used. The greatest total deformations appear with products reinforced through felting with needles and with a bigger mass on surface unit. With geotextiles consolidated by sewing – knitting and adhesive bondage the greatest total deformations have been observed. With the same type of geotextiles the total deformations are smaller if after the mechanical consolidation a chemical one was added. In the relaxation processes, the role of plastic deformations is greater than in the case of elastic recovery.

– In applications, modifications of fabrics affect negatively the filtration capacity.

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CERCETĂRI PRIVIND COMPORTAREA GEOTEXTILELOR LA SOLICITĂRI DE COMPRESIUNE

(Rezumat)

Creşterea producţiei de textile neţesute utilizabile ca geotextile a stimulat preocupările privind determinarea unor caracteristici în strînsă legătură cu solicitările reale în timpul proceselor de exploatare.

Lucrarea prezintă o sinteză a cercetărilor întreprinse pentru studiul comportării materialelor textile neţesute, utilizate ca geotextile, la solicitări de compresiune, fapt pentru care au fost elaborate mai multe metode de testare.

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Secţia VIII
TEXTILE. PIELĂRIE

VARIATION DER WASSERRETENTION IN DER NASSEN MIT SPINNMASCHINEN BEARBEITETEN FASERSTOFFMASSE

VON

CARMEN CUZIC-ZVONARU

Das Spinnen des Materials in nassem Zustand aus rohen oder chemisch behandelten Fasern erleichtert das Gleiten oder Trennen der technischen Fasern nach dem Schwellen und Gelieren der mittleren Lamelle. Praktisch hängt die Aufteilung in feinere Komplexe von der Art und dem Angriffsort der Kräfte im Streckwerk ab. Die Zusammensetzung des Fadens vom strukturellen Standpunkt aus hängt von den Dimensionen der technischen Fasern ab, die im Streckwerk kommen, von den Dimensionen der elementaren Faser, von der Festigkeit der Verklebungen und von den Werten der während des Verzugs auftretenden Beanspruchungen. Die für dieses Thema zuständige Fachliteratur geht auf wenige Einzelheiten ein. Es wird gezeigt, dass alle Fäden in nassem Zustand ungefähr zweimal so schwer sind als die trockenen [1, 2, 3].

Aus den durchgeführten Forschungen geht hervor, dass die erzielten grossen Massenunterschiede ein Beweis für die Notwendigkeit sind, die reelle eingeschlossene Wassermenge zu kennen, die am Verlauf des technologischen Prozesses aktiv teilnimmt. Im Rahmen der Arbeit wurde der Grad der Wasserbelastung auf dem Vorgarn analysiert, wobei folgende Änderungen vorgenommen wurden:

– Wassertemperatur T (20, 80)°C;

– Druckkraft auf die Eingangswalzen F_a (12, 24)N.

Es wurde ein Parameter eingeführt, genannt Kennwert der Belastung mit Wasser, I_a, beschrieben durch das auf Gemischtypen bestimmten (Tab.1 und Abb.1) Verhältnis zwischen der Masse des nassen und der des trockenen Materials ($m_{\text{nass}}/m_{\text{trocken}}$).

Die Methodologie der mathematischen Modellierung des untersuchten Aspektes [4, 5] wurde mittels des Programms PROUNFAC [6] aus der STATEX – Bibliothek angewandt.

Es ergeben sich folgende Schlussfolgerungen:

1. Es ist notwendig, die Druckkraft auf die Eingangswalzen bis zur annehmbar

Tabelle 1

	Gemisch (%)					
	in	0	33	50	67	100
	PET	100	67	50	33	0
Charakteristik	x	0	3,3	5,0	6,7	10
F_a =12 N						
m_{trocken}		3354	3420	3495	3521	3610
m_{nass}		5770	5986	6885	8134	10722
m_{Wasser}		2416	2565	3390	4613	7112
$I_a(y)$		1,72	1,75	1,97	2,31	2,97
$I_a = 1,709 - 0,023x + 0,015x^2$ (Abb.1a) (1)						
F_a =24 N						
m_{trocken}		3265	3382	3310	3450	3305
m_{nass}		3526	3686	3707	3967	4891
m_{Wasser}		261	304	397	517	1586
$I_a(y)$		1,08	1,09	1,12	1,15	1,48
$I_a = 1,083 - 0,033x + 0,006x^2$ (Abb.1b) (2)						
F_a =12 N						
m_{trocken}		3410	3307	3338	3396	3260
m_{nass}		5933	6018	6642	8150	9845
m_{Wasser}		2523	2711	3304	4754	6585
$I_a(y)$		1,74	1,82	1,99	2,40	3,02
$I_a = 1,741 - 0,015x + 0,014x^2$ (Abb.1c) (3)						
F_a =24 N						
m_{trocken}		3318	3295	3280	3365	3309
m_{nass}		3646	3696	3775	4034	4993
m_{Wasser}		328	401	495	669	1684
$I_a(y)$		1,099	1,122	1,151	1,199	1,509
$I_a = 1,113 - 0,027x + 0,006x^2$ (Abb.1d) (4)						

T_{ts} 666 tex (Nm_s 1,5); $T = 20°C$; $t = 20$ s

niedrigsten Grenze herabzusenken, um das Verbleiben einer möglichst sehr hohen Flüssigkeitsmenge auf den Fasern während des Verzugs zu verwirklichen.

Die gegenseitige Abhängigkeit zwischen der Feinheit des Vorgarns, der Druckkraft auf die Eingangswalzen, der Grösse des Verzugs und der Zusammensetzung des Gemisches kann bekannt werden durch ein Optimierungsverfahren für schnelle Eingriffe, was ein weites Feld für zukünftige wissenschaftliche Begründungen, von grosser praktischer Bedeutung darstellt.

2. Die unterschiedliche prozentuale Teilnahme der Naturfaser im Vorgarn verändert die Wasserbelastung des Gemisches, jedoch nicht in demselben Verhältnis. Je grösser der Anteil der Kunstfaser im Rezept des Gemisches ist, je geringer ist – offensichtlich – die Absorptionsfähigkeit des Gesamten, und folglich ist es notwendig, bezüglich Steigerung des Kennwertes I_a einzugreifen.

Andererseits ist auch die Gleichmässigkeit der Wasseraufnahme längs des Vor-

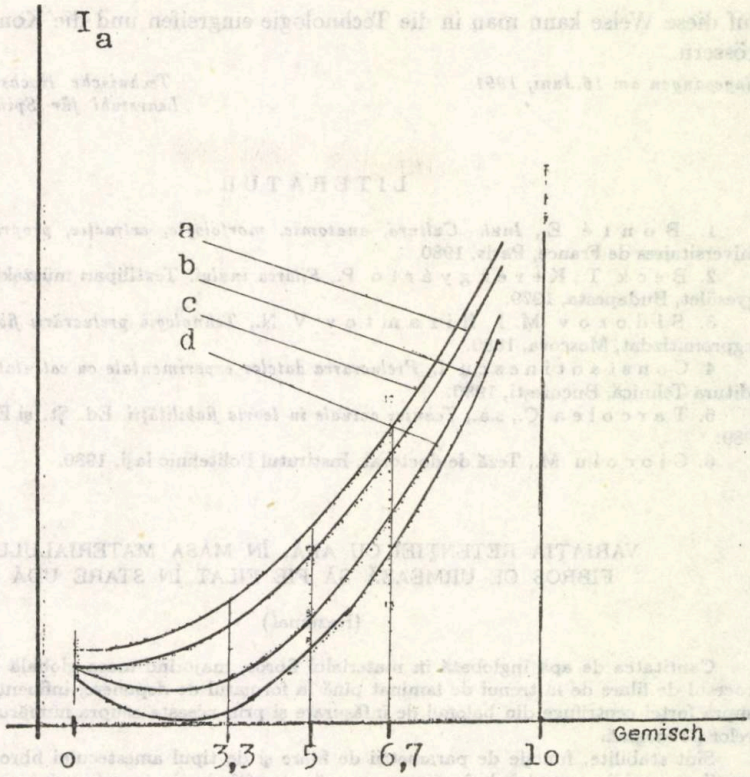

Abb. 1

garns von Gemisch zu Gemisch verschieden. Die grösste Verstreuung erscheint beim Gemisch 50 Flachs/ 50 PET, also dort wo die beiden Komponenten mit entgegengesetztem Verhalten dem Wasser gegenüber in gleichem Ausmass auf die Hydrophilie oder Hydrophobie des Vorgarns einwirken können. Es ist angebracht, bei dieser Art von Gemisch, die Druckkraft auf die Eingangswalzen des Streckwerks zu verringern.

3. Die Veränderung der Flüssigkeitstemperatur führt zu keinen wesentlichen Variationen des Grades der Belastung mit Wasser (bei einer normalen Dauer von ungefähr 20 s des Materialdurchgangs durch den Behälter), wenn auch weite Variationsgrenzen gebraucht werden (20 und 80°C). Daraus ergibt sich der wichtige Vorteil, dass der Verbrauch an herkömmlichem Brennstoff sinkt, sowie auch die Produktionskosten.

4. Die aufgestellten Regressionsgleichungen (1)...(4) beweisen ausnahmslos eine parabolische Variation. Sie helfen zum schnellen Auffinden der Charakteristiken des in nassem Zustand zu verspinnenden Materials, wenn die Verkrustungen stark verschmolzen sind und keine schnelle Eindringdynamik des Wassers ermöglichen.

Auf diese Weise kann man in die Technologie eingreifen und die Kontaktzeit vergrössern.

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VARIAŢIA RETENŢIEI CU APĂ, ÎN MASA MATERIALULUI FIBROS CE URMEAZĂ SĂ FIE FILAT ÎN STARE UDĂ

(Rezumat)

Cantitatea de apă înglobată în materialul fibros, majorînd masa globală ce participă în procesul de filare de la trenul de laminat pînă la formatul de depunere, influenţează în special asupra forţei centrifuge din balonul de înfăşurare şi prin aceasta asupra numărului de ruperi a firelor pe maşină.

Sînt stabilite, funcţie de parametrii de filare şi de tipul amestecului fibros (in + PET), ecuaţii, ce stabilesc gradul de încărcare cu apă, permiţînd prin aceasta o intervenţie operativă atunci cînd în fabricaţie apar scăderi de productivitate.

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TEXTILE. PIELĂRIE

ANALYSE DER ANATOMISCHEN EIGENHEITEN DES RUMÄNISCHEN FLACHSES BEZÜGLICH DER TEXTILBEARBEITUNG

VON

ALICE SIMION und CARMEN CUZIC-ZVONARU

Vom Standpunkt der Textilfachleute können die fünf anatomischen Teile der Flachspflanze folgendermassen beurteilt werden:

– *Die Wurzel* enthält zwar keine Fasern, sie geht aber mit der Pflanze mit, wird diese durch Ausreissen geerntet und beeinflusst so den Ertrag (5...9%)*.

– *Grund des Stengels* beinhaltet kurze, nicht ausziehbare Fasern (3...6%).

– *Der eigentliche Stengel* enthält mehrere Kategorien von Zellen, unter ihnen auch die Kolonien von Faserstoff (70...90%).

– *Die oberen Verzweigungen* ähneln, was die Struktur anbelangt, dem eigentlichen Stengel, jedoch kann man die Fasern schwer daraus heraus ziehen, da sie untereinander verflochten sind (2...15%).

– *Die Kapseln und Samen* werden getrennt behandelt, da sie für die Textilindustrie nicht in Betracht kommen.

Der eigentliche Stengel, der den wirklichen Textilwert der Pflanze ausmacht, enthält am Ende des Wachstums, im Querschnitt, mehrere Schichten mit fest bestimmten Aufgaben, die in der Fachliteratur auf verschiedene Weise behandelt werden [1, 2, 3, 4]. Im allgemeinen wird er in fünf Grundeinteilungen geteilt: Hülse, Kambium, Xylem, Mark und zentraler Holhlraum. Die Hülse hat Unterteilungen und umfasst die Textilfasern.

Beim rumänischen Flachs überschreiten die Stengel für Fasern selten (in letzterer Zeit) die Höhe von einem Meter und werden in 4 Güteklassen eingeteilt. Tabelle 1 zeigt, vergleichend, zwei von den physikalischen Parametern der Stengel, die von speziellem Interesse für die Verarbeitungstechnologie sind: der benutzbare Stengel und die Dicke der Stengelmitte.

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* In Klammer werden die Anteile angegeben, die den Beitrag zum Ganzen, ohne Samen, darstellen.

Tabelle 1

Charakteristik	M/E	Güteklasse			
		I	II	III	IV
Nutzlänge	cm	60-70	55-60	40-55	35-40
Dicke der Stengelmitte	mm	2	2	2	2,5

Der anatomische Aufbau des Flachsstengels muss dem Textilfachmann (vor allem dem Spinner) sehr gut bekannt sein, da in allen Bearbeitungsabschnitten der technischen Faser ausser dem Zellstoff der elementaren Fasern auch nicht zellstoffartige Substanzen teilnehmen, die aus den interzellulären Verbindungen, aber auch aus den benachbarten Geweben der Epidermis, des Parenchyms oder Xylems stammen.

Verfolgt man die Daten der Tabelle 2, die Kennwerte, die sowohl die Textilindustrie als auch die Landwirtschaft interessieren müssten, stellt man fest, dass die Eingriffe, die nur im biochemischen System bezüglich intensiver Entwicklung in der Wachstumsperiode unternommen wurden, ohne das zwischen dieser Kampagne und der Faserqualität existierende Verhältnis zu überwachen, mit der Zeit zur Verringerung der Qualität aus technologischer Sicht geführt haben. Diese vollkommen falsche Einstellung muss zukünfting geändert werden und das Hauptziel auf die Verbesserung des Flachsbüschelertrags im Stengel gerichtet werden, was der eigentliche Sinn der landwirtschaftlichen Tätigkeit für das Erzielen der Flachsfaser ist. Andererseits darf man nicht vergessen, welche aussergewöhnlichen Umwandlungen bezüglich Zweck die Leinenerzeugnisse erlebt haben, und zwar in Richtung Kleidung "für die ganze Saison", was die Vorbereitung von erstklassigen Rohstoffen notwending macht.

Wie aus den Daten der Tabelle 2 ersichtlich ist, haben die Qualitäten I und II der Flachsstengel eine äusserst geringe Bedeutung, was eigentlich ein Beweis dafür ist, dass sich der Flachsanbauer gar nicht um Qualität kümmert. Da das in der Landwirtschaft verfolgte Ziel die Quantität war, missbrauchte man die chemischen Düngemittel zum grossen Nachteil der Fasergüte in der Pflanze. Diese Lage verschlechterte sich von Jahr zu Jahr auch bezüglich der qualitätsweisen Verteilung der Stengel, so dass eine neue Kategorie auftauchte, die der verkommenen Stengel, zum Nachteil der Qualität I und II (Tab.2).

Tabelle 2

Stengelgüte	Verteilung der Stengel nach ihrer Qualität (%)					
	Normiert	im landwirtschaftlichen Jahr erzielt:				
		1976	1978	1979	1983	1987
I	10	2,4	1,1	0,2	0,8	1,1
II	30	20,8	14,7	2,4	12,0	10,0
III	40	46,8	38,7	25,2	37,0	36,0
IV	20	24,1	33,6	44,6	36,0	38,0
verkommene	–	5,9	11,9	27,9	14,2	14,9

Um die einheimischen Flachskulturen auf die Ebene der europäischen zu bringen, müssen tiefgehende Forschungen bezüglich Bodenvorbereitung, Fruchtbarmachung, Auswahl der den hiesigen Bedingungen am besten entsprechenden Samen, Beobachtung des Wachstums, Eingreifen ins Wachstum, Beschützen der Kulturen usw. unternommen werden.

Die Welt der Technik muss sich ein Beispiel an der internationalen Finanzwelt nehmen, und so wie diese ihre tätigen Mitglieder auf allen Wegen, Börsenkanälen, Mass-Media, über Steigen und Fallen der Aktien informiert, was vorteilhafte Geschäfte zur Folge hat, so müssen sich auch die Techniker, Fachleute bestimmter Bereiche gegenseitig über unbedingt notwendige Tätigkeiten und Leistungen benachrichtigen.

Die Länder der Europäischen Wirtschaftsgemeinschaft im Rahmen des Internationalen Verbandes für Flachs und Hanf erfahren wöchentlich das Neueste bis in alle Einzelheiten: finanzielle Probleme, Stand des Marktes, über Samen, Pflanzen, verschiedene Eingriffe, Empfehlungen betreffs entsprechender Ernte und Extraktion, Textilverarbeitung und Bestimmung. So muss auch Rumänien vorgehen, es ist der einzige Weg, um ein Flachs anbauendes und exportierendes Land europäischen Massstabs zu werden.

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ANALIZA PARTICULARITĂŢILOR ANATOMICE ALE INULUI ROMÂNESC ÎN RELAŢIE CU PRELUCAREA TEXTILĂ

(Rezumat)

Experimentări făcute pe in indigen, cu privire la repartiţia pe sorturi calitative a tulpinilor pe o perioadă de 10 ani, a scos în evidenţă aplicarea unor proceduri agrotehnice incorecte, care au degradat structura anatomică a plantei, crescînd procentual sorturile de tulpini inferioare, cu apariţie de sorturi declasat – cu ponderi exagerat de mari.

Deoarece structura anatomică a plantei de in are o influenţă covîrşitoare asupra calităţii materialului fibros extras din tulpină, se impune reconsiderarea tratamentelor chimice aplicate în perioada de vegetaţie.

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TEXTILE. PIELĂRIE

COMPUTER DESIGNING OF SEMI-DOUBLE WARP-WOVEN FABRICS AS A FUNCTION OF WEIGHT (g/m^2) I. THE ALGORITHM OF CALCULATION FOR EQUAL THREAD COUNT IN THE WARP

BY

DANIEL CHINCIU and GABRIEL CORNELIU CHINCIU

1. Introduction. Computer designing requires, as a preliminary step, working out of algorithm including the succesion of the necessary calculation stages, corresponding to their logical interdependence.

In the case of semi-double warp-woven fabrics, the algorithm proposed by the authors of the present paper is a novelty both from the view point of its content and conception. Thus, the utilization of the computer becomes possible in designing new structures or re-designing of the existing ones, starting from some pre-established criteria – in our case, g/m^2 weight [1], [2].

2. General Considerations. Semi-double warp-woven fabrics are formed of two warp systems and a filling one.

Calculation of the g/m^2 weight [3] for the finite fabrics employs the formula:

$$M = \frac{D_{us} \cdot T_{us} + D_{ui} \cdot T_{ui} + D_b \cdot T_b}{100 - A_{mu}} \cdot \frac{100 \pm p}{100} \tag{1}$$

where: D_{us}, D_{ui} – count of superior and, respectively, inferior warp, expressed as yarns/10 cm; D_b – filling count, in yarns/10 cm; T_{us}, T_{ui} – linear density of warp yarns, in tex; T_b – linear density of filling yarns , in tex; A_{mu} – average contraction on all yarns systems, as %; p – weight loss or weight addition during finishing, as %.

Yarn contraction in processes of weaving and finishing may be calculated with the following relations:

$$A_{us} = 100 - \frac{(100 - C_{tus}) \cdot (100 \pm C_{fu})}{100} \tag{2}$$

$$A_{ui} = 100 - \frac{(100 - C_{tui}) \cdot (100 \pm C_{fu})}{100} \tag{3}$$

$$A_b = 100 - \frac{(100 - C_{tb}) \cdot (100 \pm C_{fb})}{100} \tag{4}$$

Average contraction on warp systems is:

$$A_{um} = \frac{A \cdot A_{us} + B \cdot A_{ui}}{A + B} \tag{5}$$

where:

$$A = D_{us} \cdot T_{us} \cdot (100 - A_{ui})$$

$$B = D_{ui} \cdot T_{ui} \cdot (100 - A_{us})$$

Total average contraction in warp and filling systems is calculated with the relation:

$$A_{mu} = \frac{C \cdot A_{um} + D \cdot A_{um} + E \cdot A_b}{C + D + E} \tag{6}$$

where:

$$C = D_{us} \cdot T_{us} \cdot (100 - A_b)$$

$$D = D_{ui} \cdot T_{ui} \cdot (100 - A_b)$$

$$E = D_b \cdot T_b \cdot (100 - A_{um})$$

If noting: $d_u = D_{us}/D_{ui}$, $t_u = T_{ui}/T_{us}$, $d_{u2} = D_b/D_{ui}$, the factors given in relation (6) become:

$$C = d_u \cdot T_{us} \cdot (100 - A_b)$$

$$D = t_u \cdot T_{us} \cdot (100 - A_b) \tag{7}$$

$$E = d_{u2} \cdot T_b \cdot (100 - A_{um})$$

3. Designing of Semi-double Warp-woven Fabrics with an Alternance Ratio of the Yarn System of 1 US : 1 UI. Characteristics:

$$D_{us} = D_{ui} = D_u \tag{8}$$

and

$$T_{us} = T_{ui} = T_u \tag{9}$$

In this situation, contraction of the warp systems is equal in processes of weaving and finishing, being also equal with contraction's average value on the warp system:

$$A_{us} = A_{ui} = A_{um} = 100 - \frac{(100 - C_{tu}) \cdot (100 \pm C_{fu})}{100} \tag{10}$$

while:

$$A_b = 100 - \frac{(100 - C_{tb}) \cdot (100 - C_{fb})}{100} \tag{11}$$

Total average contraction will be:

$$A_{mu} = \frac{2 \cdot F \cdot A_{um} + G \cdot A_b}{2 \cdot F + G} \tag{12}$$

where:

$$F = D_u \cdot T_u \cdot (100 - A_b)$$

$$G = D_b \cdot T_b \cdot (100 - A_{um})$$

Under such conditions, the fabric's weight will be calculated with the following relation:

$$M = \frac{2 \cdot D_u \cdot T_u + D_b \cdot T_b}{100 - A_{mu}} \cdot \frac{100 \pm p}{100} \tag{13}$$

The designing methods based on weight-expressed in g/m^2 – provide three possibilities for the modification of weight, namely: modification of the density of yarns'systems, modification of yarns'linear dens ity and modification of both parameters.

3.1. Designing through count fabric modification. Parameters known: m, T_u, T_b. Parameters to be calculated: D_u, D_b.

Noting $(D_u/d_b) = d$, from which the equality $D_u = d \cdot D_b$ is obtained, and replacing it in the relation (13), the fabric's weight will be calculated with the following relation:

$$M = \frac{D_b \cdot (2 \cdot d \cdot T_u + T_b)}{100 - A_{mu}} \cdot \frac{100 \pm p}{100} \tag{14}$$

From relation (14), filling count may be derived:

$$D_b = \frac{m \cdot (100 - A_{mu})}{2 \cdot d \cdot T_u + T_b} \cdot \frac{100}{100 \pm p} \tag{15}$$

while warp count may be calculated with relation:

$$D_u = d \cdot D_b$$

where: m – imposed weight, in g/m^2; T_u, T_b – linear density of yarn systems, in tex; d – count ratio of the warp and filling systems.

From technological considerations, the count values thus calculated are rounded off, so that the last figure should be either 0 or 5.

Starting from the values established for count parameters, weight is recalculated – on applying relation (14) – and compared with the required value, then there follows decision making, considering, too, the permitted deviation.

3.2. Designing through linear density modification. Parameters known: m, D_u, D_b. Parameters to be calculated: T_u, T_b.

Noting $(T_b/T_u) = t$, from which the equality $T_u = T_b \cdot t$ is derived, and substituting it in relation (13), the fabric's weight will be calculated with the following relation:

$$M = \frac{T_b \cdot (2 \cdot D_u + t \cdot D_b)}{t \cdot (100 - A_{mu})} \cdot \frac{100 \pm p}{100} \tag{16}$$

from which the linear density of the filling yarns may be subsequently calculated, on applying the relation:

$$T_b = \frac{M \cdot t \cdot (100 - A_{mu})}{2 \cdot D_u + t \cdot D_b} \cdot \frac{100}{100 \pm p} \tag{17}$$

Also, linear density of the warp yarns may be calculated with the relation $T_u = (T_b/t)$.

The calculated values for linear density are compared with the standard values, the closest ones being selected.

Weight will be recalculated from the selected values of linear density, then, depending on the admitted deviation, the final decision will be made.

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PROIECTAREA ASISTATĂ DE CALCULATOR A STRUCTURILOR ŢESUTE SEMIDUBLE DE URZEALĂ FUNCŢIE DE MASA ÎN g/m^2 I. ALGORITM DE CALCUL PENTRU DESIMI EGALE ÎN URZEALĂ

(Rezumat)

Lucrarea prezintă un algoritm de calcul pentru proiectarea asistată de calculator a ţesăturilor semiduble de urzeală cu desimi egale. Prin concepţie şi conţinut ea corespunde condiţiilor de portabilitate pe calculatoarele compatibile PC, în orice limbaj de programare.

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CONTRIBUTIONS À L'AMÉLIORATION DU PROCESSUS D'ENCOLLAGE DES FILS DE VISCOSE

PAR
MIHAI CIOCOIU

1. Introduction. On a présenté dans l'ouvrage *Modèle mathématic du processus d'encollage des fils de viscose* [1] les equations de regression qui mettent en évidence l'influence de certains paramètres technologiques de l'instalation d'encollage sur les caractéristiques physiques et mécaniques des fils de viscose encollés. On a établi les modèles mathématiques, dont la forme finale est:

– le modèle mathématique de la charge de cati:

$$y_1 = 4,410 - 0,070x_2 - 0,080x_3 - 0,150x_4 + 0,1112x_1^2 + 0,105x_2^2 + 0,060x_3^2 + \\ + 0,036x_4^2 + 0,060x_1x_3 + 0,050x_1x_4 + 0110x_2x_3 + 0,075x_1x_4 + 0,036x_3x_4 \tag{1}$$

– le modèle mathématique de travail mécanique à la rupture:

$$y_2 = 874,508 - 7,298x_1 - 40,805x_3 - 4,299x_4 - 15,500x_1^2 - 32,985x_2^2 - \\ - 16,072x_3^2 - 23,811x_4^2 + 16,079x_1x_3 + 9,413x_1x_4 + 19,940x_2x_3 - 37,691x_2x_4 \tag{2}$$

où: x_1 = la température du cati (°C); x_2 = la vitesse d'encollage (m/min); x_3 = la pression d'essorage (daN/cm);x_4 = la tension dans la zone humide (cN/fil).

2. Interprétation technologique du modèle mathématique de la charge de cati. Le modèle mathématique obtenu pour la charge de cati contient dans sa partie linéaire seulement les paramètres x_2, x_3 et x_4. Cela veut dire que le paramètre x_1 (la température dans la cuve de cati) peut avoir n'importe quelle valeur dans la région expérimentale observée.

La variation des paramètres x_2, x_3 et x_4 de la partie linéaire exerce des influences variées sur la charge de cati, ce qui s'exprime par les valeurs différentes des coefficients de regression. C'est ainsi que la plus forte influence est exercée par

la tension dans la zone humide, dont le coefficient est de 220% plus élevé que le coefficient du paramètre vitesse de travail (x_2) et de circa 190% plus élevé que celui du paramètre pression d'essorage.

Suivent, par ordre d'importance, avec des valeurs proches, l'influence de la pression d'essorage et de la vitesse de travail. Mais l'influence de leur variation est petite étant donné leurs valeurs réduites. Les valeurs négatives de ces paramètres montrent que la charge de cati diminuera avec la variation vers les limites supérieures de la région expérimentale. Cette affirmation, ainsi que celle concernant la valeur de la température, sont valables uniquement dans les limites de la région expérimentale analysée.

Le modèle contient toutes les formes carrées des paramètres considérés, les valeurs des coefficients de ceux-ci améliorant la valeur résultante de la charge de cati. Le modèle motre que la charge de cati dépend de la totalité des interactions du deuxième ordre, capables d'intervenir entre les paramètres considérés, à l'exception de l'interaction x_1x_2.

L'influence la plus forte, exprimée par la valeur absolue du coefficient de regression, est exercée par l'interaction vitesse de travail – pression d'essorage, les autres interactions exerçant des influences presque égales sur la résultante.

L'existence du signe "plus" devant tous les coefficients des interactions montre que les deux variables devront varier dans le même sens, l'effet étant le même.

Il résulte que:

– la température du cati dans la cuve d'encollage (x_1) peut avoir n'importe quelle valeur dans les limites de la zone expérimentale. Cela confirme l'hypothèse de la possibilité de diminuer la valeur de ce paramètre, hypothèse exposée en [2].

– la vitesse de travail et la pression d'essorage ont une influence réduite sur la charge decati, par rapport à l'influence exercée par la tension de la zone humide. Cette observation justifiée mathématiquement, confirme la pratique courante de l'augmentation de la pression d'essorage lorsque la vitesse augmente et inversement. Cette nécessité de la variation concertée des deux paramètres est soulignée par la valeur du coefficient de l'interaction x_2x_3, ainsi que par son signe. Pour ce qui est de l'influence négative de la tension dans la zone humide, cette conclusion souligne et renforce les conclusions peésentées en [1].

3. Interprétation technologique du modèle mathématique du travail mécanique de rupture. En analysant la partie linéaire du modèle mathématique obtenu pour le travail mécanique de rupture, on observe que le paramètre x_2 (vitesse de travail) est absent. Cela montre que ce paramètre peut prendre, entre les limites de la région expérimentale considérée, toute valeur. Les valeurs des coefficients des autres paramètres montrent que l'influence la plus importante sur la résultante est exercée par le paramètre x_3 (pression d'essorage), ensuite par les paramètres x_4 (tension en zone humide) et x_1 (température du cati).

Les valeurs négatives des coefficients de ces paramètres montrent que le travail mécanique de rupture augmente si les variables respectives varient vers les limites inférieures de la région expérimentale considérée, situation concordante avec la réalité technologique.

C'est le reflet mathématique d'un état des choses, parce que l'augmentation de la température du cati est suivie par la diminution de la quantité de cati sur le fil. De même, l'augmentation de la pression d'essorage mène à la diminution de la charge de cati et, donc, à la diminution de la valeur du travail mécanique de rupture par sa composante – la résistance à la rupture. En plus, la croissance de la tension en zone humide a une influence négative soulignée aussi en [2], par la réduction de la capacité de déformation élastique du fil.

Le modèle contient toutes les formes carrées des paramètres considérés. Les valeurs négatives des coefficients de regression montrent que la résultante sera influencée négativment indifféremment de la direction de variation des paramètres considérés.

Le modèle établi contient les interactions du deuxième ordre de tous les paramètres, à l'exception des interactions x_1x_2 et x_3x_4.

En analysant les valeurs des coefficients, on observe que l'influence la plus grande est exercée par l'interaction x_2x_4 (vitesse de travail × tension en zone humide), bien que la résultante ne dépend pas de chaque paramètre.

La valeur négative du coefficient de cette interaction correspond à une réalité technologique, parce qu'une croissance des valeurs des deux paramètres provoque l'usure des fils et leur dégradation.

Par ordre d'influence, les interactions x_2x_3 et x_1x_3 ont des poids presque égaux. Le coefficient de regression ayant le signe "plus", il faut que la variation de ces interactions soit concertée.

La variation des paramètres x_2 et x_3, dans le même sens, qui constituie une nécessité technologique, impose une variation similaire pour les paramètres x_1x_3.

L'influence la plus réduite est exercée par l'interaction x_1x_4 (température dans la cuve × tension dans la zone humide), ce qui s'explique par la manière différente dont elle prend part au processus.

Par le modèle mathématique de l'encollage des fils de viscose il faut comprendre en fait le système des deux équations de regression établies antérieurement; la discussion de ce système permet le choix rationnel des valeurs de ces paramètres, qui peut conduire à l'obtention de fils encollés ayant les caractéristiques physiques et mécaniques nécessaires.

Le choix d'une valeur plus réduite pour la température a pour conséquence une amélioration de la valeur du travail mécanique; il n'influe nullement sur la charge de cati, en obtenant ainsi une réduction de la consommation d'énergie.

Le choix d'une valeur élevée de la vitesse de travail influe dans une certaine mesure sur la charge de cati, il n'influe nullement sur le travail mécanique de rupture, mais il accroît la productivité de la machine.

Le choix d'une pression d'essorage, liée à la vitesse de travail, qui influera le moins possible sur la charge de cati, contribuera à la réalisation de but poursuivi.

Le choix, dans tous les cas, d'une tension en zone humide la plus réduite possible, mène à l'obtention de fils aux propriétés physiques et chimiques supérieures.

4. Conclusions

1. Les modèles mathématiques obtenus ont permis de mettre en évidence la zone dangereuse du domaine de l'allongement à la rupture pour les fils de viscose 13 tex analysés. Le dépassement de la valeur de 6-7% de l'allongement total pendant le processus d'encollage mène à l'obtention de fils ayant une capacité d'usinage restreinte sur le métier à tisser.

2. Le modèle mathématique de l'encollage des fils de viscose 13 tex, exprimé par les équations 1 et 2, permet de simuler des expériences dans la région expérimentale indiquée, qui permettent de trouver les groupes de valeurs des paramètres de travail qui conviennent en fonction des conditions spécifiques de la production.

3. Le régime de tension des fils de viscose pendant l'opération d'encollage influe de facon décisive sur les propriétés physiques et mécaniques de ceux-ci, donc sur leur comportement pendant l'opération de tissage.

Cette influence est d'autant plus nocive que dans la zone suivante, a lieu la stabilisation par séchage de la structure déformée du fil encollé, avec des implications directes sur son comportement élastique.

4. Etant donné le phénomène de propagation de la tension dans diverses zones de l'installation, il est nécessaire de régler conjointement les tensions des zones. Pour établir leurs valeurs il faut tenir compte de l'influence que chaque zone exerce sur les autres et sur la tension totale de l'installation.

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CONTRIBUŢII LA OPTIMIZAREA PROCESULUI DE ÎNCLEIERE A FIBRELOR DE VISCOZĂ

(Rezumat)

Lucrarea prezintă modul de utilizare a unor modele matematice ale procesului de încleiere a fibrelor de viscoză. Se face o interpretare tehnologică a acestor modele ceea ce permite tragerea unor concluzii cu caracter practic.

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TEXTILE. PIELĂRIE

VERBESSERUNG DER PARAMETER BEIM EINFÜHREN DES SCHUSSFADENS AUF DER STB-WEBMASCHINE

VON

IOAN CIOARĂ

1. Allgemeines. Die immer breitere Anwendung der STB-Webmaschinen verlangt eine gründliche Kenntnis der Arbeitsmöglichkeiten der einzelnen Mechanismen der Maschine, so dass man durch entsprechende Regelung einen maximalen Ausnutzungsgrad erhält. Gleichzeitig müssen die Einstellungen, die man an den verschiedenen Mechanismen vornimmt, zu einer minimalen Beanspruchung der Maschinenelemente und parallel dazu zu einer Absicherung der Hauptfunktionsparameter und Verlängerung der Lebensdauer der Werkzeuge führen, was eine Reduzierung der Arbeitsstellen für die sonst notwendige Instandhaltung zur Folge hat.

Die Einführung des Schussfadens wird bei der STB-Webmaschine mit Hilfe des Projektils vorgenommen. Gegenüber dem klassischen System, mit dem Webschützen, bietet die Einführung des Schussfadens mit Projektil folgende Vorteile:

– bedeutende Energieeinsparung als Folge der Verwendung eines ca. zehnmal kleineren Masseträgers;

– Verkleinerung der Schussfachhöhe wegen der kleineren Abmasse des Projektils;

– Anwachsen der Einführgeschwindigkeit des Schussfadens.

Das Projektil bewegt sich durch das Schussfach auf der Grundlage der bei der Entladung eines Drallstabes Energie, und somit ist die Abschussenergie nicht von der Drehzahl der Kurbelwelle abhängig. Die Grösse der Abschussintensität wird vom Drallwinkel des Stabes bestimmt und angenommen unter Berücksichtigung einer Reihe von Parametern [1], wie z.B.: die Arbeitsbreite, die Drehzahl der Kurbelwelle, die lineare Dichte des bearbeiteten Schussfadens, die Fadenspannung und der verwendete Formattyp der Zuführung. Unter den besonders dynamischen Betriebsbedingungen des Drallstabes sowie dessen Kosten ist erhöhte Aufmerksamkeit bei der Regelung des Drallwinkels geboten, damit für das Projektil eine ausreichende Geschwindiegkeit zum Passieren des Schussfaches zur rechten Zeit gewährleistet wird. Es ist die Tatsache bekannt, dass, um sicher zu sein, dass das Projektil

rechtzeitig im Aufnahmekasten eintrifft, die Abschussintensität ungerechtfertigt vergrössert wird, ohne die negativen Konsequenzen auf den Beanspuchungsgrad der Arbeitsbaugruppen zu berücksichtigen. Der Zeitpunkt des Projektilabschusses muss mit der Arbeitsweise der Mechanismen zur Bildung des Schussfaches und der Lade synchronisiert werden und zwar in dem Sinne, dass bei dessen Facheintritt und während der gesamten Bewegung von einer Seite auf die andere, die Kettfäden stationär in maximal offener Stellung sich befinden müssen, und die stationäre Lade muss sich in einer extremen hinteren Stellung befinden.

Die vorliegende Arbeit hat als Ziel, die spezifischen Hauptparameter der Einführung des Schussfadens auf der STB-Webmaschine zu verbessern, damit eine entsprechende Synchronisation der Arbeitsabläufe unter bestimmten gegebenen Bedingungen verwirklicht werden kann, was immer mehr in der aktuellen Periode notwendig wird, infolge der Tendenz, den Arbeitsrhythmus der Maschinen laufend zu erhöhen.

Um die notwendigen Synchronisierungen beim Einfügen des Schussfadens herauszustellen, wurden folgende Parameter betrachtet:

α_l – Drehungswinkel der Kurbelwelle,bei dem der Abschuss stattfindet,(Grad);

α_i – Drehungswinkel der Kurbelwelle, bei dem der Austritt des Projektils aus dem Fach stattfindet, (Grad);

n – Drehzahl der Kurbelwelle der Webmaschine, (U/min);

S_i – Entfernung, die das Projektil zurücklegt, (m);

V_i – Anfangsgeschwindigkeit des Projektils, die dessen Durchlauf durch das Fach in entsprechender Zeit gewährleistet, (m/s);

C – Geschwindigkeitsverlustkoeffizient des Projektils auf einer Längeneinheit, (s^{-1}).

Die erwähnten Parameter erlauben, die Zeit (t), die notwendig ist für den Weg Projektils nach folgender Gleichung zu bestimmen:

$$t = \frac{\alpha_i - \alpha_l}{6n} = \frac{S_i}{V_i - CS_i} \tag{1}$$

Aus der Beziehung (1) wird der Winkel α_i hergeleitet:

$$\alpha_i = \alpha_l + 6n\frac{S_i}{V_i - CS_i} \tag{2}$$

Gleichzeitig kann unter den kinematischen Betriebsbedingungen des Abschussmechanismus mit dem Drallstab [2], die Abhängigkeit zwischen den spezifischen Parametern mit folgender Beziehung ausgedrückt werden:

$$V_i = K \cdot \varphi_0 \cdot d^2 \cdot \sin(\arccos \frac{12}{\varphi_0}) \tag{3}$$

mit V_i – Ausgangsgeschwindigkeit des Projektils, (m/s);

K – Konstruktionskonstante des Abschussmechanismus;

φ_0 – Drallwinkel des Stabes, (rad);

d – Durchmesser des Stabes, (m).

Im Hinblick auf eine operative und genaue Festlegung der für die Schusseinführung notwendigen Parameter, auf der Grundlage der vorgestellten Beziehungen, wurde das Regelnomogramm aus Abb. 1 aufgestellt. Dieses Nomogramm setzt sich aus drei Feldern zusammen:

Feld I – erlaubt die Herausstellung des Drehwinkels der Kurbelwelle entsprechend der Bewegung des Projektils vom Abschusskasten zum Auffangkasten. In Abhängigkeit von der Arbeitsbreite der Webmaschinen erhält man folgende Zeitdauer (ausgedrückt in Drehungsgraden der Kurbelwelle) für die Fortbewegung des Projektils:

STB-180————150°
STB-220————158°
STB-250————164°
STB-330————180°

Für die verschiedenen Typen der Webmaschinen wird die Verwendung der für die verdickten Zonen entsprechenden Parameter vorgeschlagen, die die notwendige Synchronität mit dem Ladenmechanismus gewährleistet;

Feld II – erlaubt die Festlegung der Ausgangsgeschwindigkeit des Projektils für eine der Kurbelwelle vorgegebenen Drehzahl, damit das Projektil das Fach zur rechten Zeit durchlaufen kann. Das Geschwindigkeitsniveau ist so vorgesehen, dass es die Verluste der Schussfadenreibung und – spannung aufhebt;

Feld III – führt zur Bestimmung des notwendigen Drallwinkels für die Stabdurchmesser von 14 bis 17 mm. Sein Wert berücksichtigt auch die Aufhebung der Wirkung des Ölstossdämpfers.

2. Art und Weise der Anwendung der Nomogramms. Um das Nomogramm anwenden zu können, müssen vorher folgende Daten bekannt sein: Webmaschinentyp; Abschusswinkel (α_1); Drehzahl (n) der Kurbelwelle; Durchmesser (d) des Drallstabes.

Für einen Winkel α_1 aus dem Feld I erhält man durch Ziehen einer Vertikalen bis zu der dem Webmaschinentyp entsprechenden Geraden und einer Horizontalen bis zur Ordinatenachse den Drehungswinkel α_i der Kurbelwelle, bei dem der Projektilaustritt aus dem Fach stattfindet. Durch Verlängerung der Horizontalen im Feld II des Nomogramms bis zu der der Drehzahl n entsprechenden Geraden und Verlängerung nach unten der Vertikalen erhält man den Aufangswert der Projektilgeschwindigkeit, die den Durchlauf des Projektils auf der Schussfachbreite zur rechten Zeit garantiert. Indem man die Vertikale bis zu der dem Durchmesser d der des Drehstabes entsprechenden Geraden verlängert und die Horizontale zur Ordinatenachse zieht, wird der Wert des Winkels φ_0 bestimmt, der notwendig ist zur Drehung des Stabes.

3. Schlussfolgerungen. 1. Höhere Ausnutzungsgrade beim Betrieb der STB-Webmaschine sind nur Möglich bei entsprechender Synchronisierung der Laden-, Abschussund Schussfachbildungmechanismen.

2. Das entworfene Nomogramm dient zur Festlegung der Funktionellen Abhängigkeit zwischen den Hauptparametern der Webmaschine. Die Projektilgeschwin-

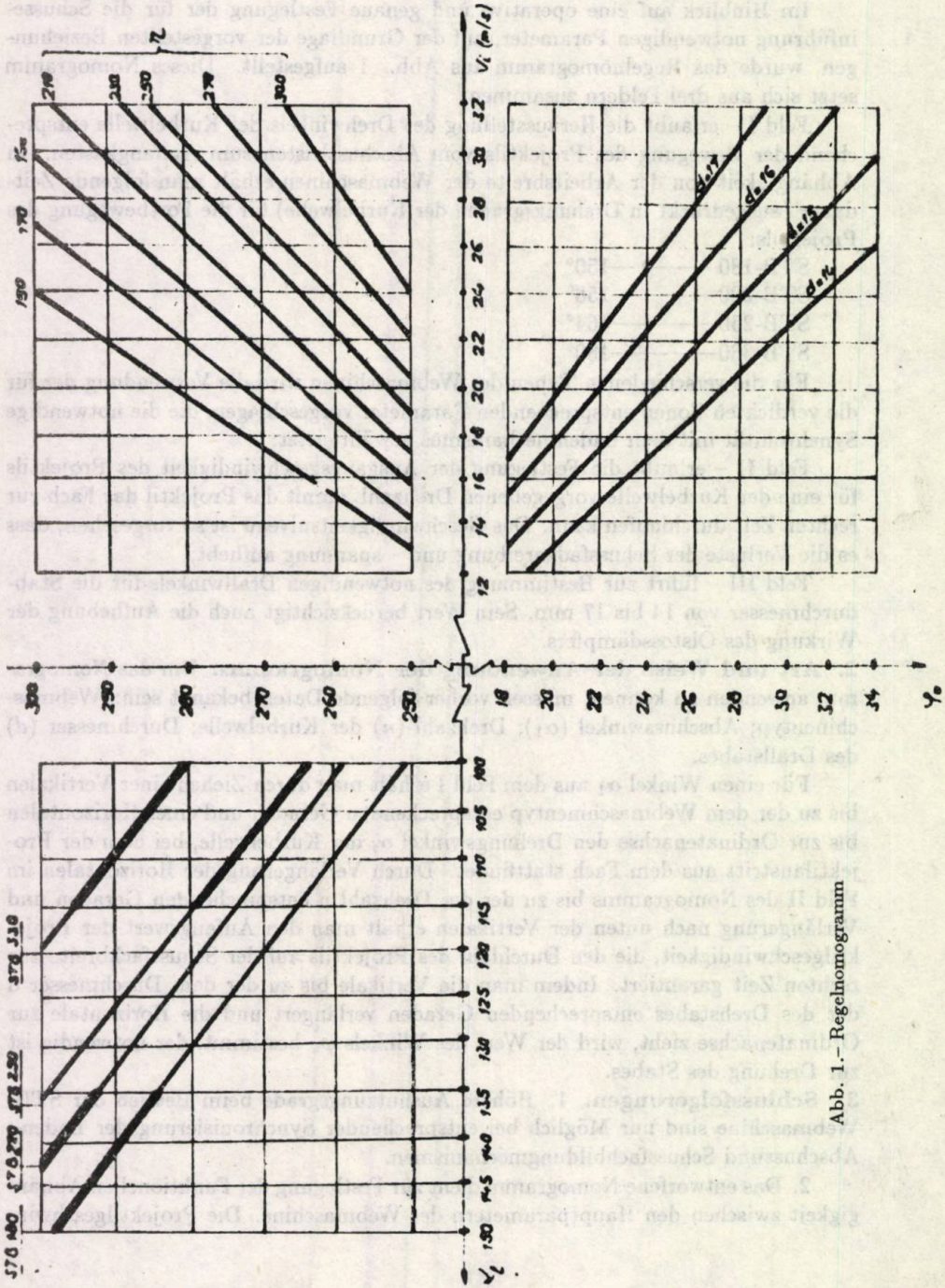

Abb. 1.- Regelnomogramm

digkeit V_i und der Drallwinkel φ_0 des Stabes, die durch das Nomogramm erhalten wurden, stellen untere Grenzen dar, die aber noch die notwendigen Synchronisationen gewährleisten.

3. Das Nomogramm stellt ein brauchbares Instrument zur operativen und präzisen Regelung der Funktionsparameter des Abschussmechanismus dar ohne die Arbeitselemente zu überlasten.

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RAŢIONALIZAREA PARAMETRILOR PRIVIND INSERAREA BĂTĂTURII PE MAŞINA DE ŢESUT STB

(Rezumat)

Lucrarea prezintă aspecte specifice inserării bătăturii pe maşina de ţesut STB. Pe baza relaţiilor de dependenţă între parametrii funcţionali s-a construit o nomogramă, care permite reglarea operativă şi cu precizie a mecanismului de lansare în condiţiile unor solicitări reduse ale organelor de lucru.

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Secţia VIII
TEXTILE. PIELĂRIE

COMPUTER DESIGNING OF SEMI-DOUBLE WARP-WOVEN FABRICS AS A FUNCTION OF WEIGHT (g/m^2) II. COMPUTER DESIGNING FOR DIFFERENT THREAD COUNT IN THE WARP

BY
GABRIEL CORNELIU CHINCIU and DANIEL CHINCIU

1. Introduction. Part I of the present study discussed the algorithm aplied in the designing of semi-double warp-woven fabrics with equal count of the two systems.

For the obtainement of different effects in the two sides, either from aesthetics or wear conform considerations, it is customary with semi-double warp-woven fabrics to apply a different count value from that of the yarns in the superior warp. In such cases, one has to work a special algorithm defining the specific structural parameters, to be subsequently applied in computer designing operations [1], [2].

2. Designing of Semi-double Warp-woven Fabrics for an Alternance Ratio of the Yarn Systems of 2US : 1UI. The most frequently met situation is when the ratio of warp systems' count is $(D_{us}/D_{ui}) = 2$, resulting that $D_{us} = 2 \cdot D_{ui}$.

The superior warp/filling count ratio is established with the relation $(D_{us}/D_b) = d_{1u}$ from which there results that $D_b = (D_{us}/d_{1u})$.

For compensating the difference in count, on assuring a similar cover factor on fabric's both sides, different values of linear density are usually employed for the warp yarns, $T_{us} \neq T_{ui}$.

The ratio of the warp yarns' linear density is expressed as $(T_{ui}/T_{us}) = t_u$, resulting therefore that $T_{ui} = t_u \cdot T_{us}$.

In total contraction of both warp and filling yarns in processes of weaving and finishing is calculated with the following relations:

$$A_{us} = 100 - \frac{(100 - C_{tus}) \cdot (100 \pm C_{fu})}{100} \tag{1}$$

$$A_{ui} = 100 - \frac{(100 - C_{tui}) \cdot (100 \pm C_{fu})}{100} \tag{2}$$

$$A_b = 100 - \frac{(100 - C_{tb}) \cdot (100 - C_{fb})}{100} \tag{3}$$

The total average contraction on warp yarns is:

$$A_{um} = \frac{A \cdot A_{us} + B \cdot A_{ui}}{A + B} \tag{4}$$

where

$$A = T_{ui} \cdot (100 - A_{us}) \tag{5}$$

$$B = 2 \cdot T_{us} \cdot (100 - A_{ui}) \tag{6}$$

The total average contraction on warp and filling yarns is calculated with the relation:

$$A_{mu} = \frac{C \cdot A_{um} + D \cdot A_{um} + E \cdot A_b}{C + D + E} \tag{7}$$

where:

$$C = 2 \cdot T_{us} \cdot (100 - A_b) \tag{8}$$

$$D = t_u \cdot T_{us} \cdot (100 - A_b) \tag{9}$$

$$E = d_{u2} \cdot T_b \cdot (100 - A_{um}) \tag{10}$$

The fabrics' weight [3] is calculated with the following formula:

$$M = \frac{D_{ui} \cdot [d_{1u} \cdot T_{us} \cdot (t_u + 2) + 2 \cdot T_b]}{d_{1u} \cdot (100 - A_{mu})} \cdot \frac{100 \pm p}{100} \tag{11}$$

Designing of a semi-double warp-woven fabrics, the weight of which – expressed as g/m^2 – is given versus the weight of a reference fabric, may be realized in three different ways, as follows: modification of the density of yarns' systems, modification of yarns' linear density, and modification of both parameters.

2.1. Designing through count fabric modification. Parameters known: m, D_{us}, T_{us}, T_b. Parameters to be calculated: D_{ui}, D_b.

Count of the inferior warp is calculated from relation (11):

$$D_{ui} = \frac{M \cdot (100 - A_{mu}) \cdot d_{1u}}{d_{1u} \cdot T_{us} \cdot (t_u + 2) + 2 \cdot T_b} \cdot \frac{100}{100 \pm p} \tag{12}$$

while count of the filling yarns with relation:

$$D_b = (2 \cdot D_{ui}/d_{1u}) \tag{13}$$

The calculated value thus obtained is rounded off so, that the last figure should be either 0 or 5.

The count values considered are employed in the recalculation of weight with relation (11), followed by the decision making, as based on the permitted deviation.

2.2. Designing through linear density modification. Parameters known: m, D_{us}, D_b, T_{us}. Parameters to be calculated: T_{ui}, T_b.

On taking $t_{1u} = (T_b/T_{us})$, where $T_b = t_{1u} \cdot T_{us}$ or $T_b = (t_{1u} \cdot T_{ui}/t_u)$, substituted in relation (1, Part I), there results that:

$$M = \frac{T_{ui} \cdot [D_{us} \cdot (t_u + 2) + 2 \cdot t_{1u} \cdot D_b]}{2 \cdot t_u \cdot (100 - A_{mu})} \cdot \frac{100 \pm p}{100} \tag{14}$$

linear density of the yarns from the inferior warp, T_{ui} is calculated by relation (14), as:

$$T_{ui} = \frac{2 \cdot t_u \cdot M \cdot (100 - A_{mu})}{D_{us} \cdot \cdot (t_u + 2) + 2 \cdot t_{1u} \cdot D_b} \cdot \frac{100}{100 \pm p} \tag{15}$$

while linear density of the filling yarns results from relation:

$$T_b = (t_{1u} \cdot T_{ui}/t_u) \tag{16}$$

The calculated value of linear density is then compared with the standard values, the closest one being selected.

There follows recalculation of weight as based on the linear density values selected and, depending on the admitted deviation, the final decision is made.

3. Conclusion. The algorithm proposed corresponds to the conditions of portability on PC-compatible computers, as well as on other types of computers in any programming language. Introduction of notions such as average contraction in weaving and finishing processes, on various yarn systems, as well as that of total average contraction, permitted to determine the basic parameters of the woven structure fabric count and yarn linear density by simple algorithms.

Methods for re-designing of a semi-double warp-woven fabric, through the modification of its basic parameters (fabric count and linear density of yarn systems), are also discussed.

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PROIECTAREA ASISTATĂ DE CALCULATOR A STRUCTURILOR ŢESUTE SEMIDUBLE DE URZEALĂ FUNCŢIE DE MASA ÎN g/m^2
II. ALGORITM DE CALCUL PENTRU DESIMI DIFERITE ÎN URZEALĂ

(Rezumat)

Lucrarea prezintă un algoritm de calcul pentru proiectarea asistată de calculator a ţesăturilor semiduble de urzeală cu desimi diferite. Prin concepţie şi conţinut ea corespunde condiţiilor de portabilitate pe calculatoarele compatibile PC, în orice limbaj de programare.

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Secţia VIII
TEXTILE. PIELĂRIE

DEVELOPMENTS IN MAKING AND USING COMPOUND NEEDLES AT FLAT KNITTING MACHINES (PART I)

BY

MIRCEA MATEESCU, STELIAN FILIPESCU and LILIANA TOADERE

1. General Elements. Weft knitted fabrics on flat knitting machines are generally made by using latch needles or latch transfer needles. Compound needles are used in making weft knitted fabrics on large diameter circular knitting machines and on warp knitting machines.

The latest speciality literature mentions patents of compound needles used by the automatic flat knitting machines [1].

Shima Seiki company patented compound needle with rib loop transfer spring on the needle used with the electronic selection by the automatic flat knitting machines [2].

The advantages of using compound needles in the automatic flat knitting machines are the following:

– a reduction of about 30% at the stroke of compound needle as compared to the stroke of the latch needle, fact wich leads to the increase of knitting speed;

– the elimination of the brushes and latch openes;

– avoiding the appearance of defects in the fabric by preventing the supply of certain needles with closed latches;

– the use of the compound needle in the area of the needle hook which is much more reduced as compared to the latch needle, fact which causes an increase of almost 10 times of its functioning duration.

In order to increase the technological posibilities of the automatic flat knitting machines, the authors of this paper propose two types of compound transfer needles:

– compound needle with a laterally extended rib loop transfer spring on the needle;

– compound needle with a laterally extended rib loop transfer spring on the closing element.

2. The Construction of the Compound Needle with a Laterally Extended Rib Loop Transfer Spring. The two types of compound needles differ from each other by the place of the rib loop transfer spring, fact which involves particularities in the movements required by the process of stitch transfer [3].

2.1. The Construction of the Compound Needle with a Laterally Extended Rib Loop Transfer Spring on the Needle. Fig.1 shows a compound needle with a laterally extended rib loop transfer spring on the needle as follows:

Fig.1.a – compound needle with a laterally extended rib loop traqnsfer spring placed on the needle (general view);

Fig.1.b – lateral and front view of the needle;

Fig.1.c – section through the head of the needle hook;

Fig.1.d – lateral and front view of the closing element.

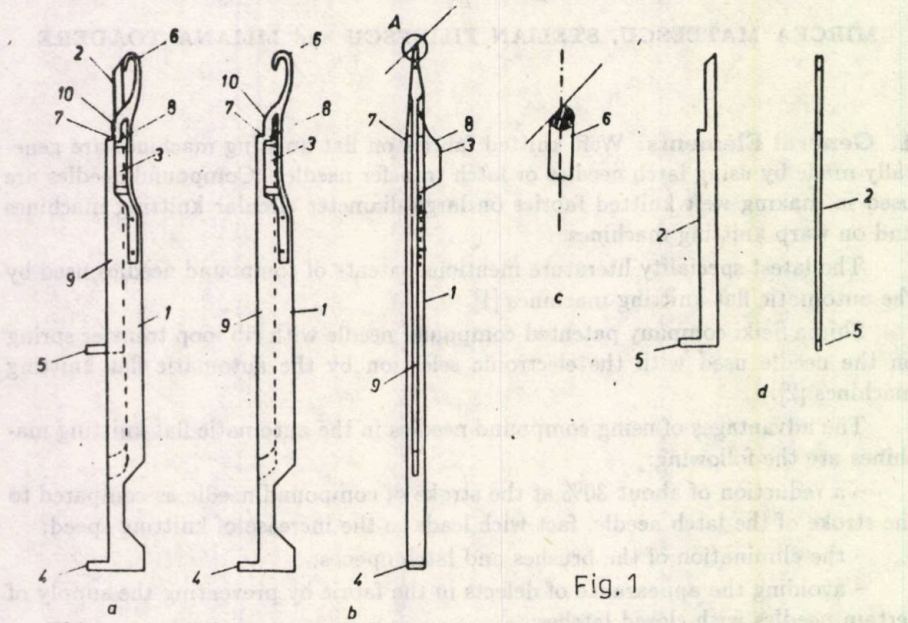

Fig. 1

This compound needle, Fig.1., consists of *1* – needle, *2* – closing element, *3* – laterally extended rib loop transfer spring, *4* – butt for coupling of the needle, *5* – butt for coupling of the closing element, *6* – hook of the needle, *7* – shoulder for supporting and stretching the old elements (stitch, loop) on the needle for transfer, *8* – shoulder for supporting and laterally extending the old elements on the rib loop transfer spring for transfer, *9* – open longitudinal trick on the needle, *10* – protuberance on the needle which ensures the maintainance of the old elements in a precisely determined position.

The needle *1* and the closing element *3* respectively move up and down in the bed's tricks by certain jacks coupled with the *4* and *5* butts.

One can observe that the closing elements *2* may move independently in the open longitudinal trick in the needle. Thus the close of the needle hook *6* is achieved

by placing the closing element *2* in a position which is tangent to it. In this way, a larger space is obtained under needle hook, fact which leads to a surer dispozition of the yarn as well as to the possibility of loop accumulation.

The protuberance *10* on the needle *1* has the role of stabilising the old elements on the closing phase, until the placing of the yarn. The laterally extended rib loop transfer spring *3*, makes knitting or the stitch transfer for the same position possible, as related to those in the two beds.

2.2. The Construction of the Compound Needle with a Laterally Extended Rib Loop Transfer Spring Situated on the Closing Element. Fig.2 shows a compound needle with a laterally extended rib loop transfer spring placed on the closing element as follows:

Fig.2.a – compound needle with a laterally extended rib loop transfer spring, placed on the closing elements (general view);

Fig.2.b – lateral and front view of the needle;

Fig.2.c – section through the head of the needle hook;

Fig.2.d – lateral and front view closing element;

Fig.2.e – lateral and front view of the B detail.

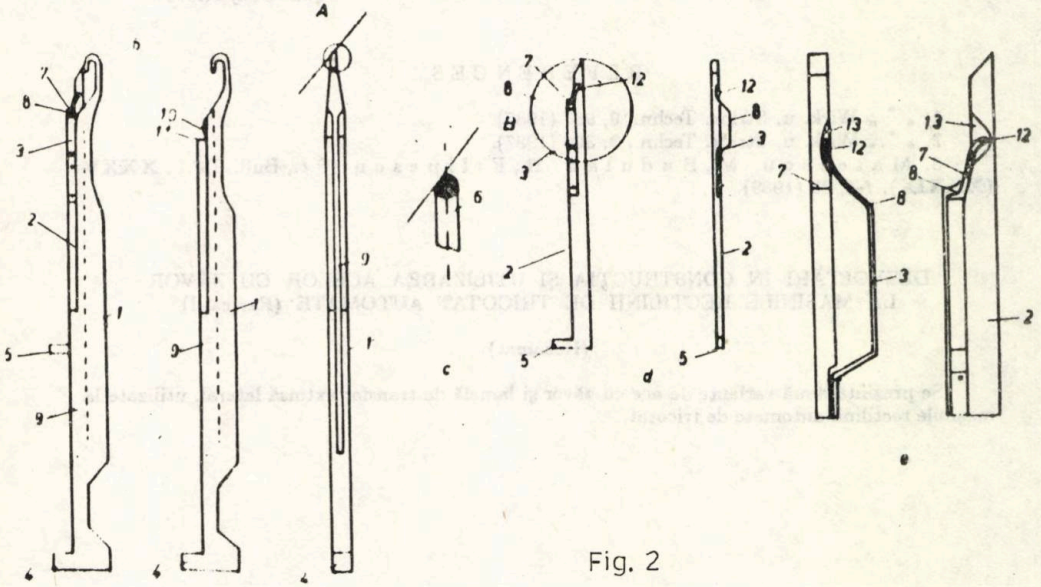

Fig. 2

This compound needle, Fig.2., consists of: *1* – needle, *2* – closing element, *3* – laterally extended rib loop transfer spring, *4* – butt for coupling of the needle, *5* – butt for coupling of the closing element, *6* – hook of the needle, *7* – shoulder for supporting and stretching the old elements (stitch, loop) on the closing element for transfer, *8* – shoulder for supporting and laterally extending the old elements on the rib loop transfer spring for transfer, *9* – open longitudinal trick on the needle, *10* –

protuberance on the needle which ensures the maintainance of the old elements in a precisely determined position, *11* – shoulder on the needle, *12* – the end of the rib loop transfer spring, *13* – mess.

As compared to the compound needle in Fig.1 this compound needle is characterized by:

– the place of the laterally extended rib loop transfer spring *3* on the closing element *2*;

– the end *12* of the rib loop transfer spring enters the mess *13* to allow the closing element to pass through the open longitudinal trick *9*;

– the place of the shoulder for supporting and stretching old elements for transfer on the closing element.

3. Conclusions. The use of the compound transfer needles by the automatic flat knitting machines needs different construction of the Knitran systems (knit or stitch transfer) for the two variants; needles lead to the increase of the machine possibilities and to the increase of their speed. Also, the machine possibilities and operating speed of the machine are raised by employing compound needles.

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DEZVOLTĂRI ÎN CONSTRUCŢIA ŞI UTILIZAREA ACELOR CU ZĂVOR LA MAŞINILE RECTILINII DE TRICOTAT AUTOMATE (Partea I)

(Rezumat)

Se prezintă două variante de ace cu zăvor şi lamelă de transfer extinsă lateral, utilizate la maşinile rectilinii automate de tricotat.

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Secţia VIII
TEXTILE. PIELĂRIE

YARN TENSION IN TEXTIMA MIDDLE STOP MOTION PART I

BY
RODICA BUBULAN

1. Introduction. Constant maintaining of the yarn tension during knitting is a main condition of knitted fabrics quality. On circular knitting machines, this demand can be obtain by:

– passing the yarn through different types of tensioning devices, which can apply a tension of a necessary level, that can cancel all the variable tensions under this level,

– passing the yarn through compensating devices, usually used as stop motion, which stop the machine for: yarn breakage, excessive or insufficient yarn tension or where a package of yarn ran out,

– positive feeding, which can be used only when the yarn speed is constant.

As a result, the existence of compensation and stop motion devices, called top or middle stop motion, is absolutely necessary because it has a double purpose: to compensate the little variation of the tension around the preset value and to stop automatically the machine when the yarn tension is getting down the limit.

For each type of such a device one can establish the limits of the yarn tension for which the machine acts [1].

The paper embarks upon solving such a problem for the middle stop motion Textima type which all the machines built by this company are provided with.

2. Presentation of the Device. The device is placed before the yarn guide at a sufficient distance to enable automatical stop in proper time, to eliminate the danger that the end of the yarn reaches the knitting zone.

According to Figure 1 the middle stop motion contains the following elements:

1 – sensing wire, as a two arms lever,
2 – spiral spring,
3 – two arm lever,
4 – adjusting screw,
5 – electric contact,
6 – case with fixed eyes.

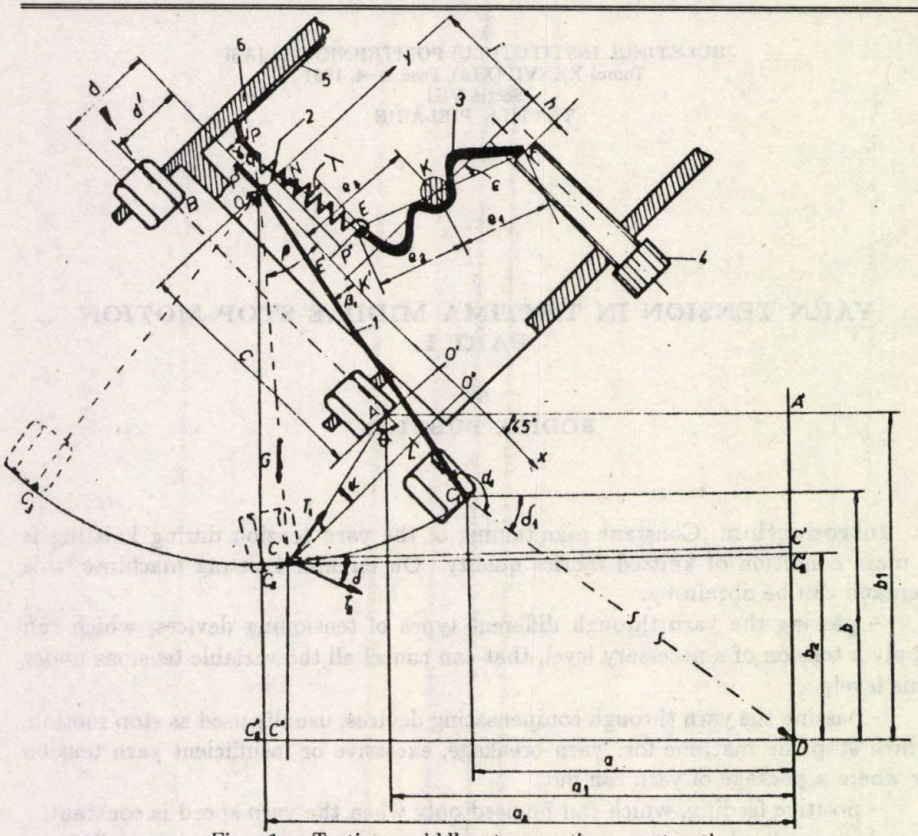

Fig. 1.– Textima middle stop motion construction

By adjusting screw *4*, the free position (without yarn) of the sensing wire *1* is determined. Under the action of the yarn the sensing wire will take a certain position determined by the yarn tensions which balance the spring tension.

Some of Textima machines have the stop motion position different from the vertical one; so is the case of Multisingle machines where the devices are placed at 45°.

3. Calculating Yarn Tension. We adopt a coordinate axes sistem Oxy which has the origin in the sensing wire link. The system of coordinates is turned 45 degrees from the vertical.

It is though that the following elements are constructively known: $a, a_1, a_2, b, b_1, b_2, c, d, d', e_1, e_2, e_3, h, j, l = OC, l_1 = OP, l_g = OG, \beta_1 = 12°, \beta_2 = 45°, \beta_3 = 82°, G$.

3.1. Calculating the Angles $\theta, \delta, \alpha, \gamma$ and λ. Theese angles can be calculated in accordance with β which determines sensing wire position.

For $\beta \in [12°; 45°]$:

In ΔALC: $\tan\theta = (l \cdot \sin\beta - d)/(l \cdot \cos\beta - c)$ (1)

$\tan\delta = \{b + l \cdot [1 - \cos(\pi/4 - \beta)]\}/[a - l \cdot \sin(\pi/4 - \beta) + l \cdot \sin(\pi/4 - \beta_1)]$ (2)

For $\beta \in [45°; 82°]$:

$$\tan\theta = (l \cdot \sin\beta - d)/(c - l \cdot \cos\beta) \tag{1'}$$

In ΔACL: $\alpha = 90° - \theta$ (3)

The sum of the angles around 0 is:

$$2\pi = \beta + \pi - \beta_1 + \pi - \gamma$$

$$\gamma = \beta - \beta_1 \tag{4}$$

In $\Delta PP''E$:

$$\tan\lambda = (e_3 - l \cdot \sin\gamma - e_2 \cdot \cos\varepsilon/(l \cdot \cos\gamma + j - e_2 \cdot \varepsilon) \tag{5}$$

For h$\in$ [0; 4] results: $\varepsilon \in [0°; 23.5°]$.

3.2. Calculating Spring Length $l_a = PE$. In $\Delta PP''E$:

$$l_a = PE = P''E/\sin\lambda$$

$$l_a = (e_3 - l_1 \cdot \sin\gamma - e_2 \cdot \cos\varepsilon)/\sin\lambda \tag{6}$$

3.3. Calculating Elastic Spring Force N.

$$N = k \cdot f$$

where: k – elastic spring constant, f – elastic spring elongation;

$$k = (G \cdot d^4)/(8 \cdot D^3 \cdot ns)$$

where: G – transversal modulus of elasticity, G=8.10^6 cN/mm^2, d – spring wire diameter, D – spring diameter, ns – no. of turns.

$$f = l_a - l_o$$

where: l_o – spring length in free state.

Results: $N = k \cdot (l_a - l_o)$ (7)

3.4. Calculating Yarn Tensions.

$$T_2 = T_1 \cdot e^{\mu(\theta + \pi/4 - \delta)} \tag{8}$$

where: T_2 – yarn tension when it leaves the mobile eye of the sensing wire, T_1 – yarn tension when it enters into the mobile eye of the sensing wire, μ – coefficient of friction yarn-eye.

Solving $\sum M_o$=0 and using (4) and (8), results:

Table 1

β°		12	20	30	40	45	50	60	70	82
θ°		0	27.5	57.8	79	87.1	94	105	114	125
δ°		36.7	36	35.4	35	34.5	34.3	33.9	33.7	33.6
α°		90	62.5	32.2	11	2.9	−4	−15	−24	−35
γ°		0	8	18	27	33	38	48	58	70
λ°	ε=0°	11.9	10.3	8.4	6.5	5.7	4.8	3.3	2	0.84
	ε=23.5°	17.8	15.9	13.6	11.5	10.5	9.5	7.7	6.2	4.9
l_a	ε=0°	19.4	19.3	19	18.5	18.2	17.7	17.7	17.1	16.4
	ε=23.5°	15.8	15.6	15.2	14.8	14.6	14.4	13.8	13.2	12.4
N	ε=0°	35.3	33.6	33.4	31.9	30.9	29.9	27.7	25.1	21.7
	ε=23.5°	19	18.1	16.7	14.9	13.9	12.8	10.3	7.6	4.1
T_1	ε=0°	7.4	1.9	1.2	0.97	0.9	0.86	0.76	0.67	0.54
	ε=23.5°	6.5	1.5	0.77	0.53	0.44	0.37	0.24	0.1	0.04
T_2	ε=0°	7.7	2.3	1.6	1.43	1.39	1.35	1.27	1.16	0.98
	ε=23.5°	6.8	1.72	1.03	0.78	0.68	0.59	0.4	0.19	0.1

$$T_1 = \frac{N \cdot l_1 \cdot \sin(\gamma + \lambda) + G \cdot l_g \cdot \sin(\pi/4 - \beta)}{l \cdot [\cos(\alpha + \beta) + e^{\mu(\theta+\pi/4-\delta)} \cdot \cos(\pi/4 - \beta + \delta)]}$$

To calculate the 1-9 relations, a computer program was achieved, the results being presented in Table 1.

4. Interpretation of the Results and Conclusions. Using the data in Table 1, to draw the graph in Fig.2, we presented yarn tensions variation as a function of angle β. The calculated and graphically presented values correspond to the extreme positions of the adjusting screw *4* (ε=0°-23.5°). Analysing the graph one can draw the following observations and conclusions:

i – yarn tension values being higher than those corresponding to the initial position ($\beta = \beta_1$), when the three eyes are in line, maintain the sensing wire in this position,

ii – yarn tension values between the lines A and B ($\beta \in [12°; 45°]$) are those which correspond to a normal machine functioning; the level of these values could be adjusted through the screw *4* in the interval shown in the graph,

iii – yarn tension values lower than those correponding to B position (β=45°) determine the automatic stoppage of the machine (because the sensing wire *1* touches the electric contact *5*) and the sensing wire compensates the yarn up to the C position (β=82°).

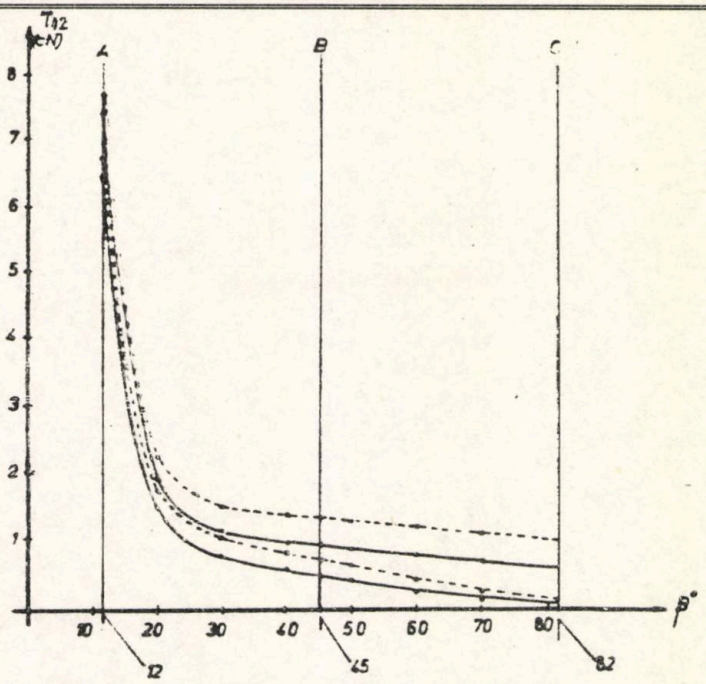

Fig. 2.– Yarn tension variation versus the β angle

Changes in the middle stop motion position (e.g. vertical setting) will alter the situation which can be similarly solved out.

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Polytechnique Institute, Jassy,
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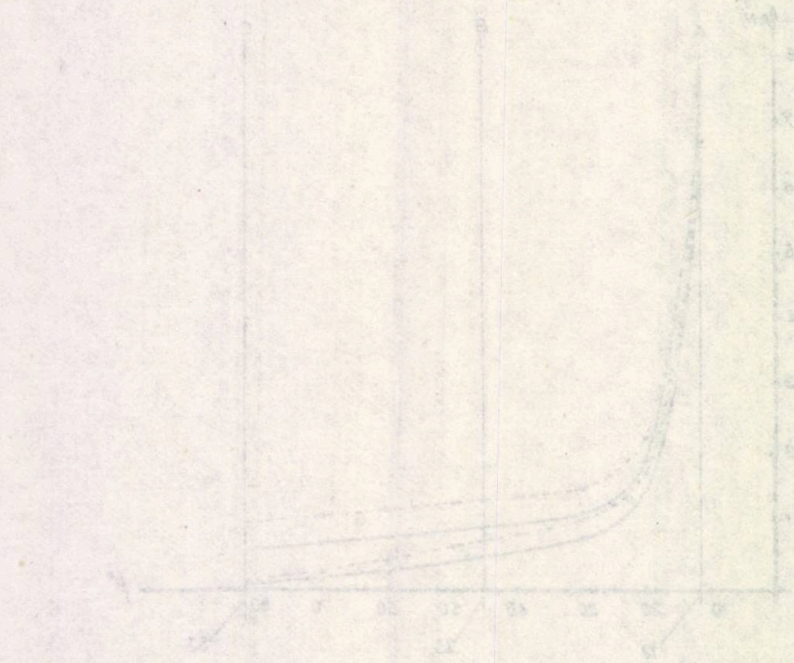
TENSIUNILE ÎN FIR ÎN DISPOZITIVELE DE COMPENSARE A TENSIUNII ŞI DE OPRIRE AUTOMATĂ TIP TEXTIMA (Partea I)

(Rezumat)

Pe baza analizei principiului de funcţionare a dispozitivelor de compensare a tensiunii şi de oprire automată instalate pe maşinile circulare de tricotat de tip Textima, s-a realizat calculul intervalului de variaţie a tensiunilor în fir, în cadrul acestor dispozitive, cu precizarea domeniilor de funcţionare şi de nefuncţionare a maşinii.



BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
Tomul XXXVII (XLI), Fasc. 1–4, 1991
Secţia VIII
TEXTILE. PIELĂRIE

CAD AND PATTERN DRUMS FOR KNITTING MACHINES

BY
COSTEA BUDULAN

1. Introduction. Universal circular knitting machines with pattern drums can produce Jacquard knitted fabrics in 2, 3 or 4 colours. Patterning device programming requires a qualified personnel, it is time-consuming and the errors that can appear are not detectable until the fabric is produced. Using a personal computer we can eliminate all these troubles.

2. Pattern Mechanism Presentation. Pattern drums mechanisms operate at the selector jack level (1). The selector jack has a patterning butt C_D that can be placed at more levels (Fig.1). It has also a raising butt and a lowering butt for lowering the selector jack.

Pattern data are stored on pattern drums, on which circumference pattern combs or two positions pattern keys are placed.

Pattern information are transmitted by means of selector blades. The number of the selector blades is equal to the total number of the possible levels for the patterning butt.

The selector blades mechanically read the information. At each feed the pattern key is slotted into unit and has a number of pattern bits equal to the number of selector blades. When a pattern bit is left on a key, it pushes a selector blade towards the rotating cylinder. Where there is a patterning butt at same level, it is struck by the selector blade and pushed into its trick. The jack raising butt is thus moved behind the jack raising cam and is not lifted, and thus a float stitch ("Miss") is formed. If the patterning butt is not struck by a selector blade the jack is lifted by the raising cam and so is the needle. The code will be:

P for the first situation (the patterning butt is struck by the selector blade) and the tehnological effect will be a float stich.

G for the second situation and the tehnological effect will be a normal stitch.

The pattern dimensions b (in wales) and h (in courses) are calculated in certain conditions, as follows:

a) the pattern width b:

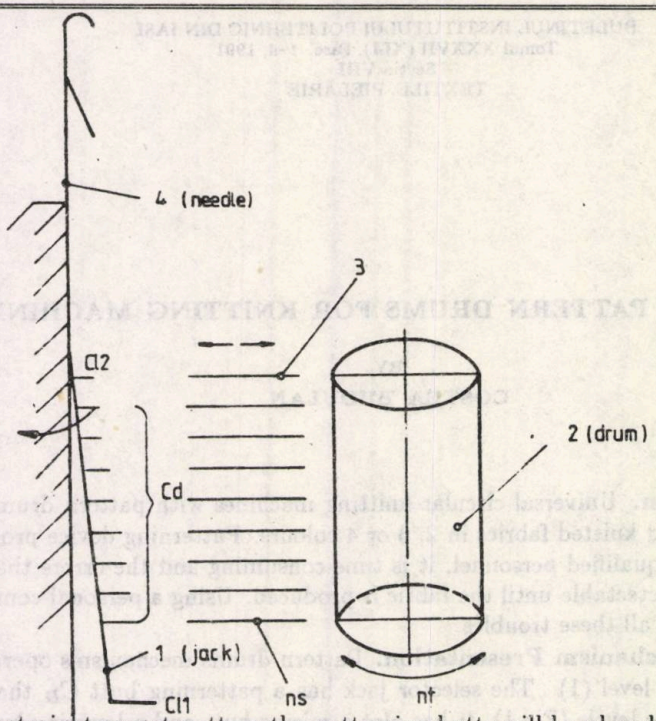


Fig. 1

– for a straight repeat pattern the patterning butts will be placed on a diagonal;

$$b = ns - 1$$

where: ns is the number of levels a patterning butt can be placed in:
– for a mirror repeat the patterning butts are placed in a v form.

$$b = 2(ns - 1)$$

– for patterns containing straight repeat zones and mirror repeat zones the patterning butts will have a combined arrangement, corresponding to the type of each zone. As a result, the width of the pattern will increase.

b) the hight of the pattern h be determined by s = the number the pattern drums that the knitting machine is equipped with; nt = the number of pattern keys placed on the pattern drum circumference; z = the number of colours used in a course.

$h = nt * s/z$ (courses)

3. Cosiderations on the Programme Structure. Pattern drums programming was possible through a conversational programme that has the following stages:

– tehnical characteristics of the knitting machine: s, ns, nt.

– the maximum pattern dimensions $hmax$ and $bmax$.

– the pattern must fulfil the following conditions: b must be a divide of the $bmax$ and h of $hmax$.

– establishing the colour code representing the pattern displaying and the feeding order.

– the pattern displaying with the possibility of modifying the errors that can appear and printing.

The programming is ended with the following table:

courses	feed	colour	level	order of bits
	s	z	nt	p g p g p g p g p g p

4. Conclusions. The computer pattern drums programming assures an impressive shortage of programming errors.

The computer programme allows the programming of circular knitting machine with similar pattern devices for jacquard knitted fabrics.

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CAD ŞI TAMBURI DESENATORI PENTRU MAŞINI DE TRICOTAT

(Rezumat)

Lucrarea prezintă soluţia programării cu ajutorul calculatorului a tamburilor desenatori, la producerea tricoturilor Jaquard pe maşini circulare de tricotat cu diametru mare.

Pornind de la raportul desenului introdus în calculator, va fi afişat pe monitor tabelul complet de programare a tuturor treptelor tamburilor desenatori pentru tricotarea raportului de desen ales.

Programul de calcul a fost elaborat pentru calculatoare din familia TIM-S, ZX, SPECTRUM, HC-86 în limbaj BASIC, program ce poate fi uşor trecut pe calculatoare PC-IBM sau compatibile.

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Secţia VIII
TEXTILE. PIELĂRIE

AUTOMATIC CARRIER DEVICE ATTACHABLE TO THE FOOTWEAR SEWING MACHINE

BY
DAN-FLORIN CROITORU

1. Need and Possibility of Accomplishing Some Automatic Carrier Devices Attachable to the Sewing Machine. As sewing is a successive processing operation, it keeps on being critical in what the output is concerned in spite of all the improvements which have been done lately to the sewing machines. Thus, although the maximum working speed of these machines have been greatly increased, in practice the effective speed is much smaller, being determined by the limits of the human possibilities.

Another method of increasing the output for sewing operation is, as already known, the accomplishing of some sewing machines in which the material subjected to the sewing operation is automatically carried away by means of a programming control system. The material is thus given a plane movement so that the relative trajectory of the centre of the hole through which the needle has access to the shuttle is identical with the contour of the seam to be done. The control systems used for this purpose can be numerical or cam-type ones, respectively.

The numerical programming control systems have the advantage that the number of stitches of the seam possible to be obtained is unlimited and that the accomplishing time of the control program is very short. However, the usage of such machines is relatively restricted as they are very expensive and they need a maintenance and repairing personnel with a special training.

The cam-type control systems are simpler, stronger and cheaper but they allow only the accomplishing of seams with a limited number of stitches (as much as fifty); that is why they can be used only for decorative and for border trimming seams, respectively.

As the automatic seaming machines equipped with a cam-type programming control system differ from the usual sewing machine only by the method the carrying of the material is being done, an automatic carrier device has been drafted and produced as part of a research contract between the specialized department of

the "Gh. Asachi" Polytechnical Institute of Jassy and the "Aurora" Shoe Factory, Tîrgu Frumos. This device can be attached to an usual sewing machine and it allows – by means of some suitable cams – the obtaining of any seam closed contour for which the number of stitches should be 32.

2. Adjustment of the Machine-Type Which Is to Allow the Attachment of an Automatic Carrier Device and the Establishing of the Device Structure. As it already known, at the usual sewing machine, the material is generally carried away along only one direction, i.e. from the operator to the machine itself, although the slight turning of the material in a horizontal plane is possible. If there is a forced displacament of the material in another direction, for instance, from the left to the right of the operator, it is possible that the interweaving of the two yarns with which the seaming is done, should not be accomplished. Therefore, a prime criterion to be taken into account when we choose the machine to which our drafted device should be attached, was that the interweaving of the yarns should be possible, no matter what the displacement direction of the material could be.

On analysing the sewing machines to be found at "Aurora" Shoe Factory, it has been noticed that the PFAFF 544-4 sewing machines best meet this case [1]. Such a machine (Fig.1) has, as well, the advantage that between the horizontal platform *23* on which the material is placed during sewing and the lower side of the frame *1*, there is a sufficient space to allow the mounting of the component elements of the automatic carrier device. One can note that in Fig.1 the component elements of the sewing machine are presented by dashed lined while the elements of our drafted device by continuous ones. All the component elements of the device rest on the horizontal plate *11* which is screwed on the platform *23* of the sewing machine.

It is also specified that in Fig.1 the assembly of elements *22, 24* constitutes the supporting holder of the material to be seamed. This holder is fastened by the screws *20* to the carrier element *26* which belongs to the structure of a two-degrees-of-mobility plane mechanism with the help of which the necessary movement of the material is obtained. The holder is provided with a clamping device for the material, a device which is not shown in Fig.1 but which will be subsequently described. Thus the material will be properly carried away by the holder depending on the position of the hole *21* through which the needle *25* – clamped on the rod *3* – has access to the shuttle to be found under the platform *23* of the sewing machine. The plate *22* of the holder should, of course, be provided with a bore whose contour must be identical with that of the seam lest the passage of the needle should be hindered.

The initial driving element of the device is the worm screw *7* directly connected by a proper coupling to the main shaft of the sewingmachine, a shaft on which the belt pulley *6* through which the machine receives its power from the electromotor, is to be found. The worm *7* drives the worm gear *8* which forms a common body with the vertical shoft *9* supported at the lower side by the plate *11* and at the upper one by the holder *4* which is fastened by the screwn *5* to the frame *1* of the sewing machine. On the vertical shaft *9*, the disk *10* is fixed up, a disk which

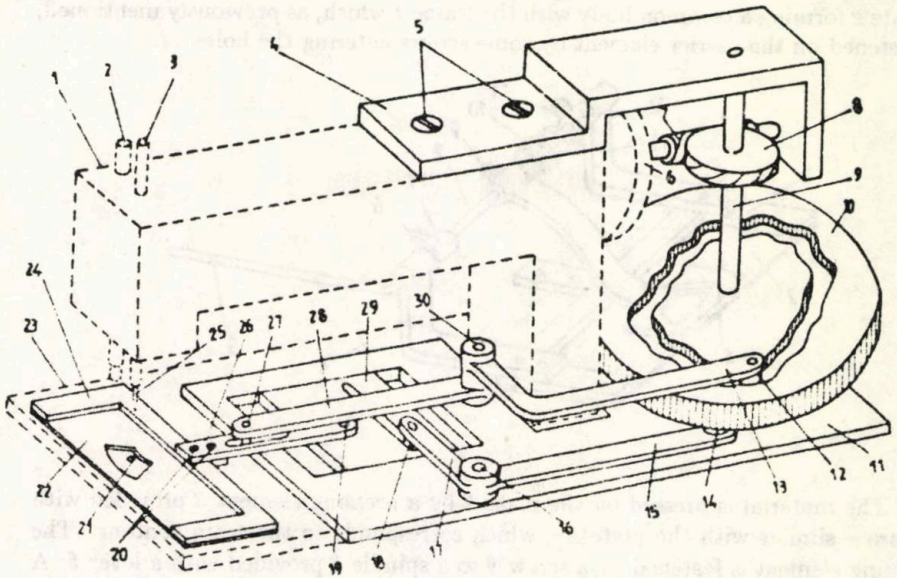

Fig. 1

represents the common body of the two cams ensuring the plane, intermittent and programmed movement of the material. The cams are plane and of the split type, one of the grooves being done on the upper side of the disk *10*, the other one on the lower side of the same disk. As the cams should change themselves when another seaming contour is desired, the disk *10* is fastened on the shaft *9* by a key, being easily replaceable, although for this purpose, the upper holder *4* should be previously demounted.

The upper cam from the disk *10* drives the sledge *13* joined by a bolt *30* to the plate *11*. The connection between the cam and the sledge is done by the bowl *12*.

The lower cam on the disk *10* drives – by means of the bowl *14* – the sledge *15* joined, as well, to the plate *11* by a bolt *16*.

The sledge *13* which forms a common body with the driving element *28* of the two-degrees-of-mobility plane mechanism, the element *28* driving the carrier element *26* by means of the bolt *27*.

The sledge *15* which forms a common body with the second driving element *17* of the two-degrees-of-mobility plane mechanism, an element which drives in its turn the slider *29* to which the carrier element *26* is joined by the bolt *19*. This is the modality by which the controls from the two cams arrive to the carrier element and therefore to the material subjected to the seaming operation; thus results the movement required for the obtaining of the desired seam contour.

The device with the help of which the material to be seamed is fixed on the holder is shown in Fig.2. The holder on which the material is placed, is made up of

a plate *2* forming a common body with the frame *1* which, as previously mentioned, is fastened on the carrier element by some screws entering the holes *14*.

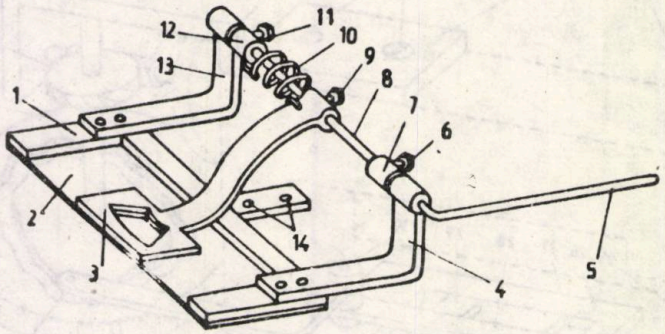

Fig. 2

The material is pressed on the plate *2* by a pressing element *3* provided with a bore – similar with the plate *2* – which corresponds to the seam contour. The pressing element is fastened by a screw *9* to a spindle *8* provided with a lever *5*. A spiral spring *10* forces the pressing element to push down the material on the plate *2*. By the hand drive of the lever 5, the pressing element can be raised up, the introduction or the taking out of the material being thus possible. The spindle *8* is supported by the bearings *4* and *13* clamped on the frame *1*. The bushes *7* and *12*, fixed by the screws *6* and *11*, hinder the axial displacement of the spindle *8*.

The dimensions of the supporting holder must correspond to the maximum sizes of the material to be seamed.

The whole automatic carrying system – with the exception of the material supporting holder – is covered by a protective casing, not presented in Fig.1.

3. Designing Elements of the Command Cams for the Material Carrying Operation. After establishing the contour of the seam to be obtained and the determination of the positions of the needle stitches on this contour, the number of the stitches in the seam – which should not be higher than 50 – is determined. Thus, the gear transmission ratio $i = n$ of the worm gearing *7,8* (Fig.1) as well as the angle $\alpha = 2\pi/i$ with which the cams rotate during a cycle (i.e. a complete rotation of the main shaft of the sewing machine) are found out [3].

During the rotation of the cams with an angle α, two phases will be necessary, namely,

a) a passive phase, corresponding to the time during which the needle is in the material, a phase to which corresponds a rotation angle $\beta = \delta/i$ (δ being the angle with which the main shaft of the sewing machine rotates when the needle is in the material);

b) an active phase during which the material must be carried away from a stitch accomplished at a given moment to the next stitch, a phase to which a rotation angle $\gamma = \alpha - \beta$ corresponds.

To determine the theoretical profile of the cams from the distance to be covered by the material from one stitch to another, it is necessary to establish the corresponding positions of the bowls *12* and *14* (Fig.1) of the two sledges, by the distances $R1$ and $R2$ between the axes of these bowls and the axis of the shaft *9* on which the cams are mounted. However, for this purpose, it is necessary a corresponding synthesis calculus of the two-degrees-of-mobility plane mechanism by the help of which the material carrying is obtained. [2]

On knowing – for each stitch from the seam contour – the values of the parameters $R1$ and $R2$, and by using, as well, the angles β and γ, it is possible to establish the theoretical profiles of the two cams by the coordinates of some points belonging to these profiles.

Finally, on the basis of the theoretical profiles, one could accomplish the real profile of the cams by means of a coordinate milling machine.

4. Conclusions.

1. The automatic carrier device of the material, a device usable for footwear sewing machines suggested in this paper, can be attached only to those machines at which the interweaving of the yarns is possible, no matter what the displacement direction of the material could be.

2. Before attaching the suggested device to a sewing machine, it is necessary that the pressing element of the machine – found fastened at the lower side of the rod *2* (Fig.1) – should be demounted because its presence would hinder the mounting of the device.

3. The kinematic structure of the suggested device being a simple one, the production of the component parts can be accomplished in any maintenance and repairing workshop of a shoe factory.

4. By using such an automatic carrier device for the accomplishing of a seam with a trapezoidal contour with 32 stitches, the output was increased by 2.5 times.

5. The time necessary for establishing the initial data for a seam contour with 32 stitches – the processing time for these data in computer being also included – does not exceed 1.5 hours. The processing time of cams is also added here.

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Polytechnic Institute, Jassy,
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DISPOZITIV DE TRANSPORTARE AUTOMATĂ ATAŞABIL LA MAŞINA DE CUSUT FEŢE PENTRU ÎNCĂLŢĂMINTE

(Rezumat)

În lucrare este prezentat un dispozitiv care poate fi ataşat la o maşină de cusut obişnuită şi care asigură transportarea automată a materialelor ce se îmbină, rezultînd o cusătură cu un contur bine determinat.

Dispozitivul se bazează pe utilizarea unei comenzi program de tipul cu came, astfel că atunci cînd se doreşte să se obţină un alt contur de cusătură, trebuie să se schimbe camele. În lucrare sînt prezentate şi unele elemente de proiectare a acestor came.

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Secţia VIII
TEXTILE. PIELĂRIE

THE DESIGNING OF SOME FOOTWEAR MARKS ASSISTED BY COMPUTER

BY

GABRIELA MĂLUREANU and MARIANA COCEA

The constructive designing of leather or substitutes products in the conditions of the present diversification of raw material base and also of the permanent increase of the beneficiaries exactigness, is a complex process which involves a larger and larger sphere of specialists [1].

The always growing demands of the leather or substitutes products impose their fast renewoland for some short periods of time and their permanent diversification.

All of these lead to an increase in the designing studies volume and complexity, concomitant with the necessity of creation-designing cycle, shortening in the conditions of qualitative level raising up for the products, which ensure the competitivity in the competition conditions both on the internal market and on the external one [2].

In the classical footwear designing, the quality of the studies and their fulfilment time, depend fundamentaly on the designer qualification and experience.

The consumed time for a new modell patterns construction, is allocated not as for technical solution, search as for their transposal on paper and for the obtaining of graphic solution.

The elimination of these troubles can be realised in the conditions of conceiving and use of some computer assisted designing programmes for some footwear marks and underensembles.

The study herein is centred upon this direction, and it presents the results of the undertaken study for the conceiving and use of a programme, wich can afford the assisted on computer designing for one of the footwear composition marks, and this is the rigid heel counter.

The mark constructive designer must have permanently in mind the fulfilment of the orthopaedic role, which the rigid heel counter is having in the footwear structure, as long as the beneficiary uses the product, and also must have in mind

the differentiations imposed by the characteristic features of the footwear manufacturing technology [1,3].

The function of this mark in the footwear structure is to rigidify and to maintain the spatial form of the posterior zone of the footwear, and in the same time to enable an as possible touch between the foot and the footwear, to prevent the change of heelbone place from the normal positin and to encourage in this way, the appearance of the flat foot.

For the fulfilment of this functional role in the footwear use process, the heel counter designing must be done differentially taking account of a footwear characteristic features set in which structure is included the kind and the destination, the heel height, the assamblage variant of the sheets with linings.

If we consider rigid the cover taken out from the last posterior zone (Fig. 1), this can be useful for the getting of the outline of heel counter conventional spread, the outline configuration depending on the flatten edway of the spread.

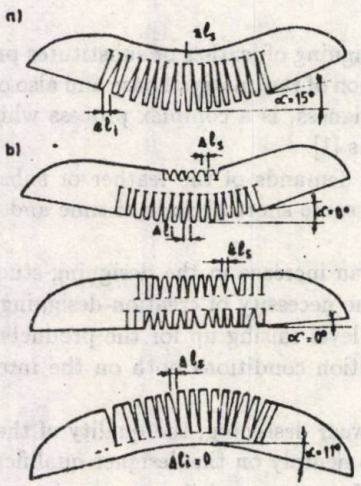

Fig. 1

Though change of place of neutral strips and cut bands position; is altering the rigid cover plane transposition, the tilted angle of the heel counter wings according to the horizontal direction, and also is altering the length of superior and inferior outline on the heel in comparison with the outline corresponding length on the last wich must be wrapped up on the mark.

At the heel counter carcasse passing from space to plane, the length of the superior and inferior outline is increasing in the same time with the increase of Δl_s and Δl_i distances between the bands.

It is ascertained that for the $\alpha = 0, \sum \Delta l_s \cong \sum \Delta l_i$.

In the case of shoes kind of footwear, for to enssure the compression of the heel zone of the foot and ni through this to enssure stable balance conditions in

dynamics, it is necessary that both the top of the boot superior edge and the heel counter one be strongly tensioned.

The mark rational designing involves also the prevention of the outline distorsion because of the modifications which take place in the technological process.

In this direction we must take account of the outline length under the complex solicitation actions to which the heel conter is submitted, for the time of the technogical processing (thinning, preformation, spatial formation, etc).

So the heel counter designing must be done decreasing the outline length on its superior part, in the conditions of high up direction for the heel counter wing according to the horizontal axis (Fig. 1a,1b), the decrease being as more enemphasized (α angle larger) as the heel height will be greater.

The heel counter inferior outline must correspond to the inferior outline of the vertical and longitudinal section of the last.

The OB segment of the section (representing about 41% Lp, where Lp is the foot length for which the footwear is destined), is almost a straight-line and that's why the inferior outline of the heel counter in this zone can be traced like a straight-line.

Fig. 2

From the B point, the inferior outline of the vertical and longitudinal last section, is differentiated according to the heel height differentiation, brought into relief through the β angle dimension (Fig. 2).

The length of the heel counter wings must be also collegated with the heel height (the length of the heel counter wing must increase with the heel height growth) for the ensurance of stable balance conditions in dynamics, at the heel raising on a higher heel.

Taking account of all these indicated in the foregoing, at a heel counter construction destined to footwear manufactured on standardized lasts from Romania, it suggested to adopt the parameter from the Table 1.

The rigid heel height must be by about 5 mm less than the top of the boot height at shoes (the standardized parameter according to the footwear size).

Table 1

The footwear destination and the heel height	Angle [°]		The length of the segment OB [%Lp]
	α	β	
for women			
– high heel	5	24	55
– medium heel	3	16	45
– low heel	2	8	42
for men	3	10	42

The heel counter outline on its superior part will be traced a little rounded

off, just to enssure an as closer as possible touch between the heel counter and the foot.

The tracing reserve on the inferior part of the mark, will be adapted differentially, according to the footwewar manufacturing system, in which composition is involved the heel counter, as it is shown in the Table 2.

Table 2

The manufacturing system	The reserv breadth [mm]
I.L. strick sole	15
C.R. sewed on the frame sole	14
I.T. tubular footwear	3

In accordance with these principles considered like a calculus algorithm, it was conceived a programme on IBM-PC compatible computer, which to permit the heel counter, its structure being given on below.

```
2700 ' The designing of some footwear marks assisted on computer
2705 SCREEN 1:CLS:WINDOW(-1450,-250)-(1450,1490):KEY OFF
2710 LDCM=259:OA=55:OK=.42*LDCM:OB=.4*LDCM
2711 OA=10*OA:OK=10*OK:OB=10*OB
2715 AG=2:BG=8:PI=3.14:AR=PI*AG/180:BR=PI*BG/180
2720 PI=3.14
2730 MK=TAN(AR):MB=TAN(PI-BR+AR)
2735 MB=-TAN(BR-AR)
2750 LD=OK: A1=MK:B1=-1:C1=0:GOSUB 4000:XK=XCP:YK=YCP
2760 LD=OB:A1=MK:B1=-1:C1=0:GOSUB 4000:XB=XCP:YB=YCP
2765 'PRINT "xk,yk";XK;YK,"xb;yb";XB;YB
2770 NB=YB-MB*XB
2780 A1=MB:B1=-1:C1=-NB:A2=1:B2=0:C2=OK:GOSUB 8500
2790 XK1=X:YK1=Y:'PRINT "xk',yk'";XK1;YK1,"ok,ob";OK;OB
2791 YM=YK1:'YK1=YK1-15
2792 LINE(-OK,0)-(OK,0):LINE(0,0)-(0,OA)
2793 X1=0:Y1=OA:X2=OK:Y2=0:X3=XK1:Y3=YK1:GOSUB 10000
2796 XC=0:YC=0:X=XK1:Y=YK1:GOSUB 3010:ALF2=ALF
2797 ALF2=-ALF2+2*PI-.15:ALF=-ALF2+2*PI
2798 CIRCLE(0,0),OK,,ALF2,PI/2,OA/OK-.15
2799 XC=0:YC=0:X=-XK1:Y=YK1:GOSUB 3010:ALF1=ALF+.2
2800 CIRCLE(0,0),OK,,PI/2,ALF1,OA/OK-.15
2810 R=-100:XK=XK:YK=YK:LINE(0,0)-(XB,YB):LINE(XB,YB)-(XK1,YM)
2811 LINE(0,0)-(-XB,YB):LINE(-XB,YB)-(-XK1,YM)
2815 LINE(0,R)-(XB+40,YB+R)'LINE(XB,YB+R)-(XK,YK)
2816 LINE(0,R)-(-XB-30,YB+R)
2820 X1=0:Y1=R:X2=XB:Y2=YB+R:X3=XK:Y3=YK
```

```
2821 GOSUB 8000:X1=XB-20:Y1=(C-A*X1)/B
2825 'CIRCLE(XC,YC),R,,ALF2,ALF1 :PRINT XC;YC;R;ALF1;ALF2
2830 LINE(0,0)-(0,R)
2990 A$=INKEY$
2995 IF A$="" THEN GOTO 2990 ELSE WIDTH 80
2999 STOP
3010 IF (X-XC)=0 AND Y>YC GOTO 3080
3020 IF (X-XC)=0 AND Y<YC GOTO 3090
3025 AA=ABS((Y-YC)/(X-XC))
3030 IF X>XC AND Y>=YC THEN ALF=ATN(AA)
3040 IF X<XC AND Y>=YC THEN ALF=-ATN(AA)+3.14
3050 IF X<XC AND Y<=YC THEN ALF=ATN(AA)+3.14
3060 IF X>XC AND Y<=YC THEN ALF=-ATN(AA)+2*3.14
3065 'PRINT "a";ALF;
3070 RETURN
3080 ALF=3.14/2 :PRINT "a";ALF;:RETURN
3090 ALF=3*3.14/2 :PRINT "a";ALF; :  RETURN
3140 RETURN
3510 P1=A1*B2*C3 :P2=A2*B3*C1 :P3=B1*C2*A3
3520 P4=A3*B2*C1 :P5=B3*C2*A1 :P6=B1*A2*C3
3530 D=P1+P2+P3-P4-P5-P6
3540 RETURN
3610 'a*x^2+b*x+c=0
3620 IF A=0 THEN GOTO 3720
3630 DELTA=B^2-4*A*C
3640 IF ABS(DELTA)<.000001 THEN GOTO 3690
3650 IF DELTA<0 THEN GOTO 3710
3660 X1=(-B+SQR(DELTA))/(2*A)
3670 X2=(-B-SQR(DELTA))/(2*A)
3680 KOD=0:RETURN
3690 X1=-B/(2*A) :X2=-B/(2*A)
3700 KOD=1 :RETURN
3710 KOD=2
3715 STOP
3720 IF B=0 THEN STOP
3730 X1=-C/B:KOD=3:RETURN
```

In the Fig. 3 and Fig. 4, are rendered for example, two of the heel counter variants, designed with the help of this programme, one of them destined to female footwear with high heel (Fig. 3), and the other one to the footwear with medium heel (Fig. 4), and both of them for Nm=24 cm [4].

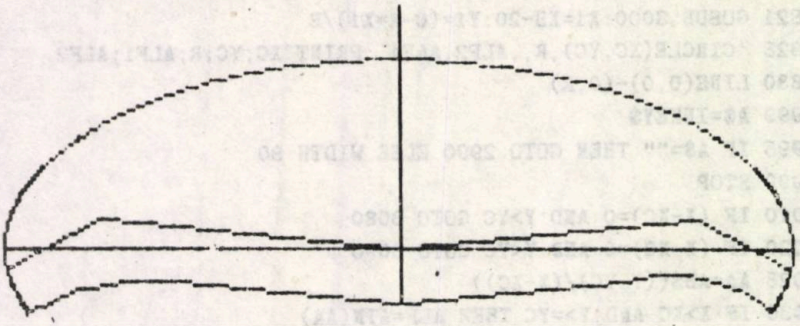

Fig. 3

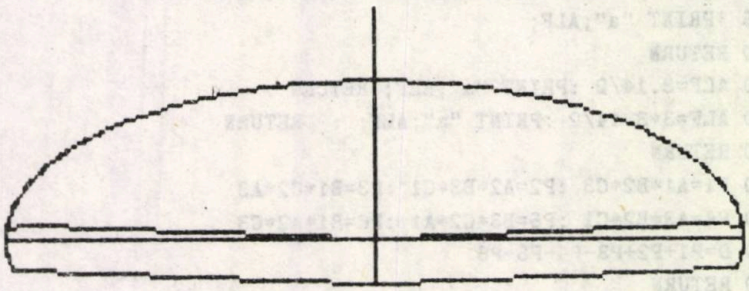

Fig. 4

The programme, having a general character, can be used to the designing of any heel-counter type, and later on as a begging element for the elaborating of same leader programmes of the products manufacturing technology.

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PROIECTAREA ASISTATĂ DE CALCULATOR A UNOR REPERE DE ÎNCĂLŢĂMINTE

(Rezumat)

Pe baza unor principii elaborate privind construcţia raţională a şaifului în vederea îndeplinirii funcţiei ortopedice în structura produsului în care se regăseşte, s-a alcătuit un program care poate servi la proiectarea acestui reper în funcţie de cerinţele impuse de produsul de bază.

BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
Tomul XXXVII (XLI), Fasc. 1–4, 1991
Secţia VIII
TEXTILE. PIELĂRIE

LA VARIATION DE CERTAINS PARAMÈTRES ANTHROPOMÈTRIQUES DES PIEDS AUX ENFANTS DU GROUPE L'ÂGE ENTRE 0 À 7 ANS

PAR
CORNELIA IONESCU et FLORENTINA HARNAGEA

1. Introduction. Pour beaucoup de domaines de la science, à partir de l'anthropologie jusqu'au design,les dimensions anthropomètriques représentent des données primaires indispensables dans l'étude et l'analyse des populations. Au cas des populations humaines les modifications sont dues particulièrement aux mutations survenues dans la vie socio-économique toute entière.

2. Mode de travail. Le travail s'est proposé de suivre la variation à la longue de certains paramètres anthropométriques des pieds, aux enfants du groupe de 0-7 ans. C'est ainsi qu'on a fait des analyses des paramètres principaux qui sont à la base des projets des embauchoirs et des chaussures [1]; longueur du pied (Lp), largeur des orteils (ld), largeur du talon (lc), périmètre du coup-de-pied (Pr), périmètre de la cheville (Pg), périmètre sous les genoux (Psg), hauteur de la cheville (Ig), hauteur de la cuisse (Ip), hauteur sous les genoux (Isg) mésurés en millimètres et les paramétres de la sommatique de l'accroissement: l'âge (V) en années, la hauteur de corps (I) en centimètres, le poids du corps (G) en kilogrammes.

Par modélation statistico-mathématique [2] on a calculé les moyennes a- rithmétiques pondérées des paramètres anthropométriques au niveau du chois ($\overline{X}$) et au niveau de la population ($\overline{X}_{\min}$; $\overline{X}_{\max}$) pour chaque année de vie comprise dans le groupe d'âge.

On a vérifié la représentativité du chois [3] pour chacun de 7 échantillons d;âge (0-1 an; 1-2 ans; 2-3 ans; 3-4 ans; 4-5 ans; 5-6 ans; 6-7 ans) fondée sur la loi de la distribution normale unidimensionnelle Gausse-Laplace pour tous les paramètres anthropométriques y présentés.

3. Résultats et commentaires. En guise de conclusion générale on remarque des accroissements d'une année à l'autre de tous les paramètres ce qui s'explique par le rythme continu d'accroissement des dimensions du corps, aux enfants, en premier cycle de vie; mais il faut faire remarquer que ce rythme est différencié à la

longue.

Le paramètre de la longueur du pied dans les premieres 3 ans de vie a un grand accroissement; 18,4 mm dans la première année, 2,30 mm dans la deuxième année, 33,2 mm dans la troisième, puis de plus en plus lent dans les années qui s'en suivent les accroissements étant compris entre 5,6-8,8 mm.

Le paramètre de la longueur des orteils a un accroissement maximum entre 2-3 ans de 10,9 mm, moyenne entre 0-2 ans de 6,1-6,4 mm par an et ensuite une évolution plus lente entre 4-7 ans.

De la même manière varie le paramétre – langeur du talon.

En analysant les périmètres on remarque au périmètre des orteils (Pd) et au périmètre du coup-de-pied un grande rythme d'accroissement dans les 3 premiers ans et puis plus lent dans les années suivantes; le plus petit niveau d'accroissement se remarque entre 3 et 4 ans.

Le périmètre au talon a un accroissement maximum entre 2-3 ans de 38,3 mm et minimum entre 3 et 4 ans de 3,5 mm.

De la même manière avec la variation des paramétres qui sont à la base des projets des embouchoirs mis en évidence dans les graphiques des figures 1-5, ont été analysés les paramètres aussi qui à côté de ceux-ci sont à la base de la projection des chaussures, leur variation est mise en évidence dans les graphiques des figures 6-12.

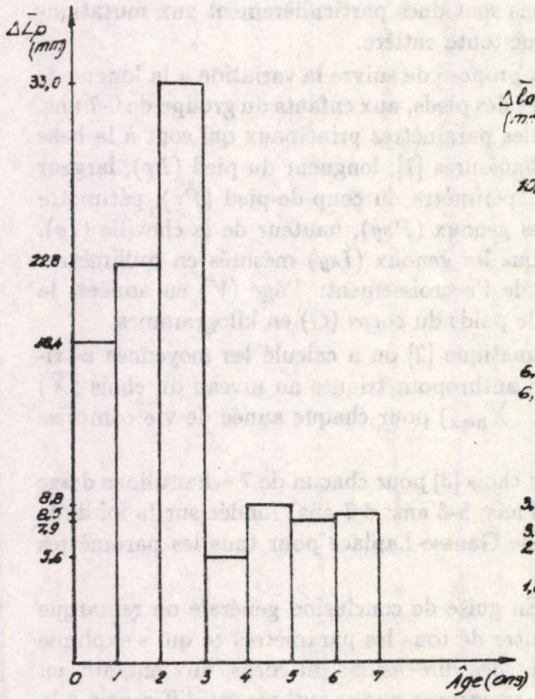

Fig. 1

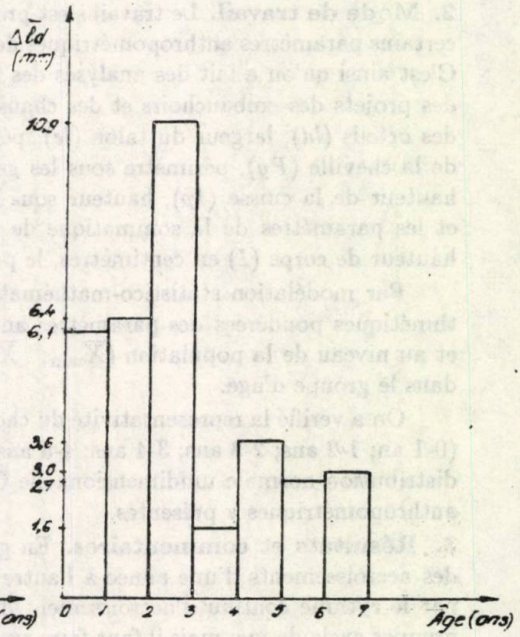

Fig. 2

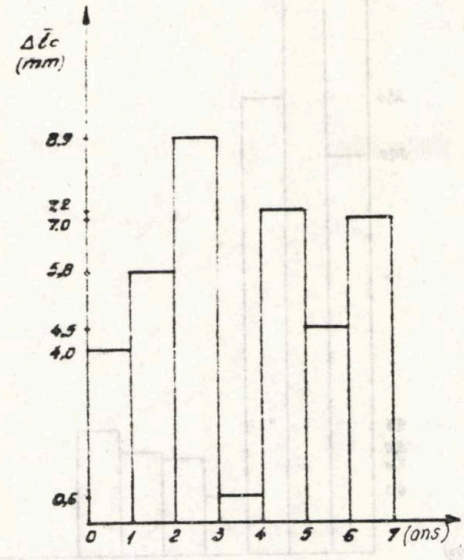

Fig. 3

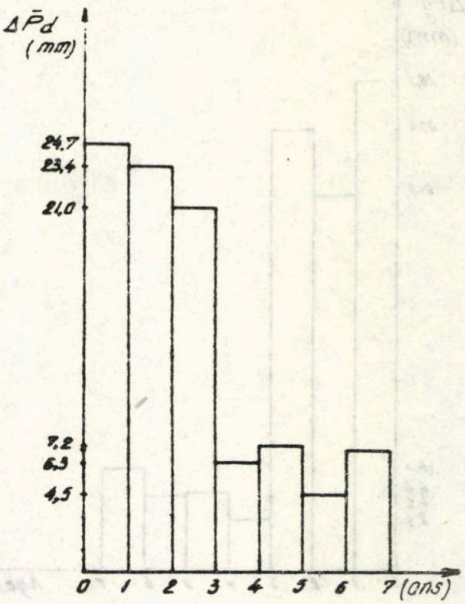

Fig. 4

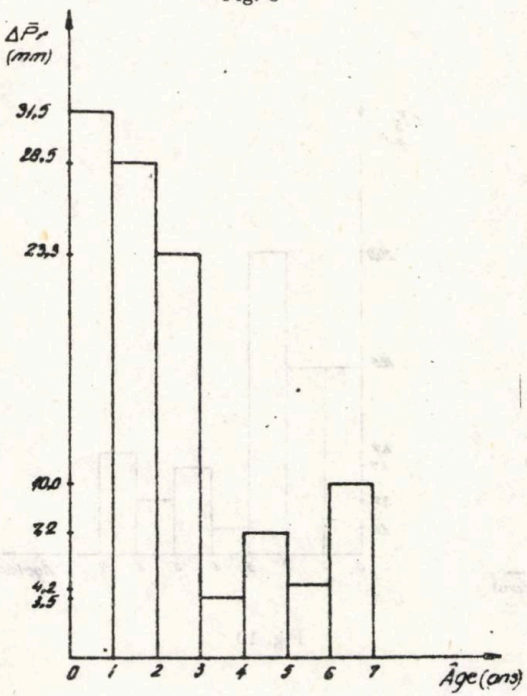

Fig. 5

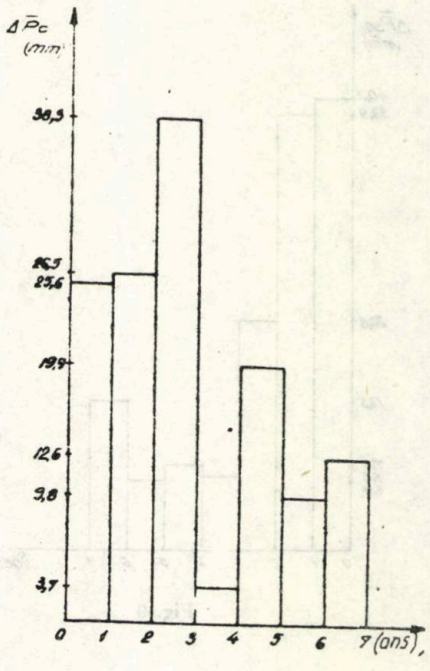

Fig.6

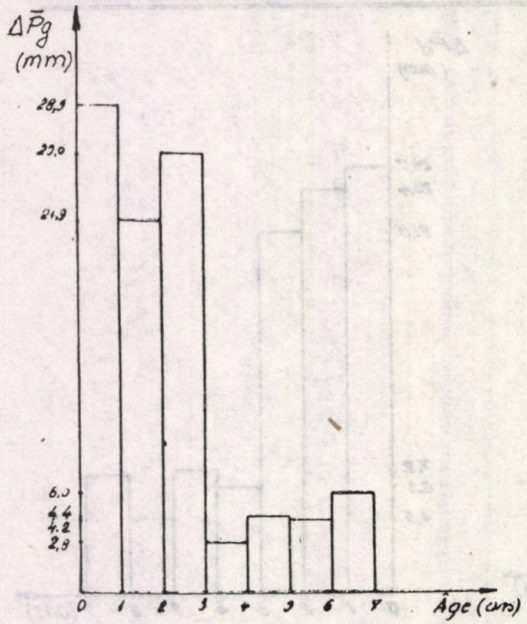

Fig. 7

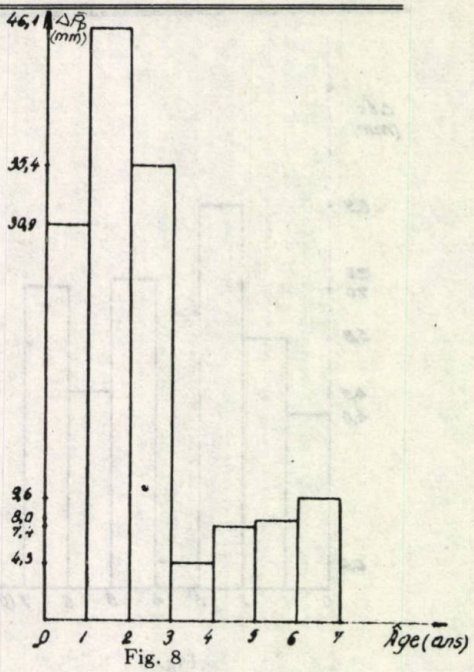

Fig. 8

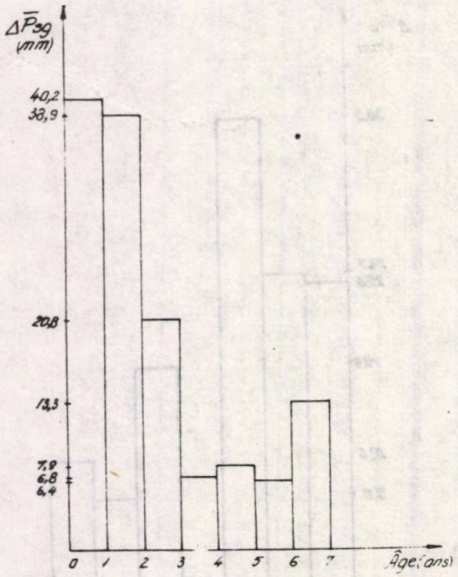

Fig. 9

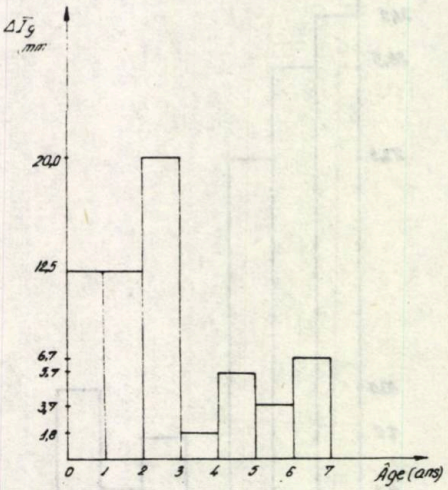

Fig. 10

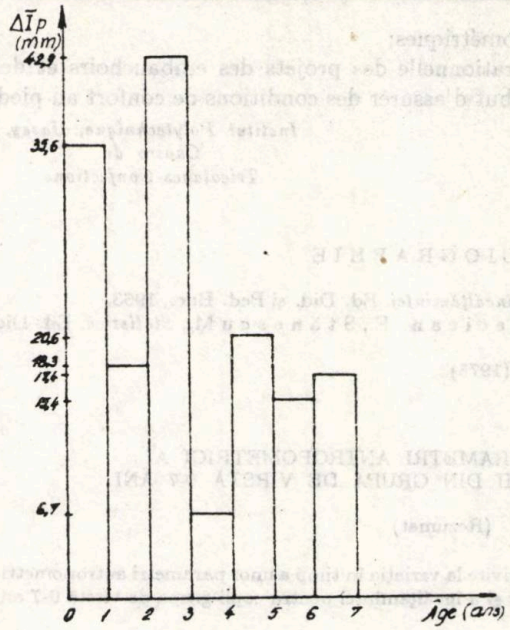

Fig. 11

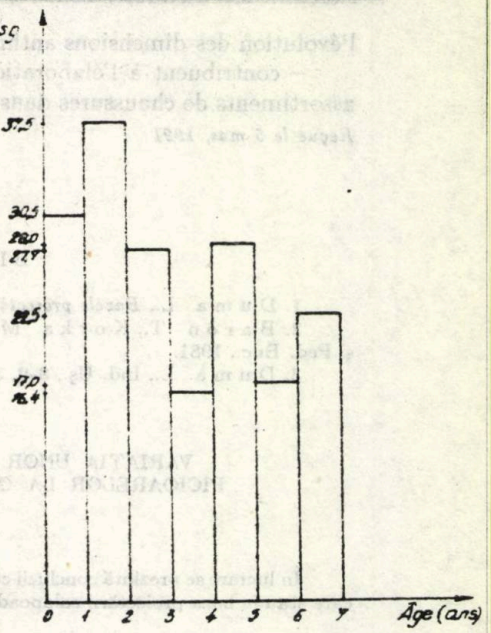

Fig. 12

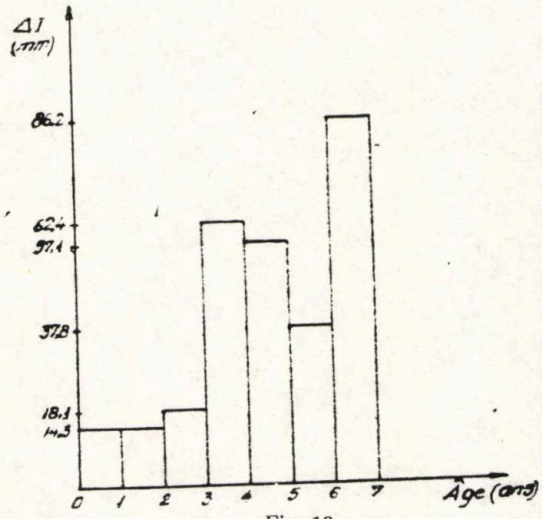

Fig. 13

En suivant l'évolution du paramètre somatique, la hauteur du corps, dans la figure 13, on constate des rythmes différents d'accroissement pendant les 7 années; dans les trois premières années la hauteur du corps grandit environ 14,3-18,1 centimètres par an, dans les deux années suivantes environ 57,1-62,4 cm par an, de 5 à 6 ans 37,8 cm et ensuite il y aura lieu une grande explosion d'accroissement de 86,2 cm entre 6-7 ans.

Le poids du corps varie en relation directe avec la hauteur du corps.

En suivant les variations des paramétres pour les valeurs minimo et maximo au niveau de la population, on constate que la valeur du domaine de l'existance de la moyenne est petite ce qui démontre que le chois a un pourcentage élevé de représentativité.

4. Conclusions. Les résultates de l'étude:

– expliquent et mettent en valeur les aspects théoriques de l'existence et de

l'évolution des dimensions anthropométriques;

– contribuent à l'élaboration rationnelle des projets des embauchoirs et des assortiments de chaussures dans le but d'assurer des conditions de confort au pied.

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VARIAŢIA UNOR PARAMETRI ANTROPOMETRICI AI PICIOARELOR LA COPII DIN GRUPA DE VÎRSTĂ 0-7 ANI

(Rezumat)

În lucrare se prezintă concluzii cu privire la variaţia în timp a unor parametri antropometrici care stau la baza proiectării calapoadelor şi a încălţămintei pentru copii grupa de vîrstă 0-7 ani.

BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
Tomul XXXVII (XLI), Fasc. 1–4, 1991
Secţia VIII
TEXTILE. PIELĂRIE

ASPECTS CONCERNANT L'INFLUENCE DU TRAITEMENT SUPERFICIEL AVEC LE PRODUIT ROUMAIN "HALOGENE H" SUR LA RÉSISTANCE DU RACCORD PAR ADHÉRENCE

PAR

FLORENTINA HARNAGEA et CORNELIA IONESCU

1. Introduction. L'adhésion d'un produit pelliculogène à la surface d'une matière, se réalise à la suite de l'action des forces intermoléculaires ou des intéractions chimiques entre l'adhésif et le substrat [1].

Selon nos connaissances, la résolution des cas les plus difficiles d'adhérence entre les substrats de caoutchouc et l'adhésive poliuréthanique se fait par différents traitements chimiques, parmi lesquels l'halogénation des substrats étant employée couramment [2, 3, 4].

L'halogénation des surfaces de caoutchouc a un rôle déterminant sur l'adhérence de la pellicule adhésive au substrat de caoutchouc.

L'halogénation des semelles de caoutchouc se réalise par leur effacement avec des substances contenant du chlore ou par immersion. Comme substances contenant du chlore, utilisées à la modification chimique du substrat de caoutchouc, on peut utiliser les substances qui cèdent un ou plusieurs atomes de chlore dans une ambiance de solvants organiques [2, 3, 4].

Outre les observations mentionnées, les auteurs du travail ont poursuivi la modification des propriétés superficielles du substrat de caoutchouc thermoplastique par un traitement avec l'agent d'halogénation ainsi que l'influence du traitement superficiel sur le résistance de la jonction par adhérence.

Dans ce sens, on a utilisé le produit roumain "Halogène H" – agent d'halogénation qui a à la base la chloramine B et une solution aqueuse de solvants cétoniques comparatif au produit allemand "Primer XG" utilisé couramment à l'halogénation des semelles de caoutchouc thermoplastique.

2. L'influence du traitement superficiel sur l'étalage de l'adhésif. Pour poursuivre l'effet du traitement superficiel d'halogénation sur les propriétés d'humectation de la surface du caoutchouc,on a employé,dans les expérimentations, la méthode de mesure de dyamètre de la surface d'étalage des gouttes de liquide

de volume constant, déposées sur la surface du caoutchouc thermoplastique [1].

La modification des propriétés superficielles du caoutchouc thermoplastique a été mise en évidence, en utilisant comme test, l'étalage de l'eau distillée. On a recouru à l'eau parce que celle-ci a la tension superficielle la plus grande des liquides employés couramment et présentant en même temps des propriétés polaires remarquables [1].

À la suite du traitement superficiel, à l'étalage de l'eau sur la surface du caoutchouc thermoplastique on a obtenu des valeurs plus grandes du diamètre de la surface d'étalage qu'avec les preuves témoin (accroissement de 31-54%). Il en résulte que les modifications subies par traitement avec le produit "Halogène H" ont agrandi l'adhérence solide-liquide, ce qui a conduit à des expérimentations concernant le moyen d'étalage des liquides adhésifs.

Le traitement des substrats de caoutchouc thermoplastique s'est réalise avec le produit "Halogène H" après quinze minutes depuis le mélange des deux composants et les gouttes de liquide de volume constant ont été déposées après trente minutes depuis l'application et le séchage du produit d"halogénation.

Les résultats des expérimentations effectuées dans des éprouvettes-témoin et des éprouvettes traitées par et immersion avec les produits "Halogène H", respectivement "Primer XG" concernant l'étalage de l'eau distillée et de l'adhésife poliuréthanique "Aderom 551" se trouvent sur le tableau 1.

Tableau 1

Le traitement	L'eau distillée						Adhésif poliuréthanique-Aderom 551					
	Primer XG			Halogène H			Primer XG			Halogène H		
	$\overline{D}_p$	$\Delta\overline{D}_p$		$\overline{D}_p$	$\Delta\overline{D}_p$		$\overline{D}_p$	$\Delta\overline{D}_p$		$\overline{D}_p$	$\Delta\overline{D}_p$	
	(mm)	(mm)	(%)	(mm)	(mm)	(%)	(mm)	(mm)	(%)	(mm)	(mm)	(%)
Le témoin	2,32	–	–	2,32	–	–	4,81	–	–	4,81	–	–
Effacement	3,04	0,72	31,03	3,24	0,92	39,6	5,41	0,60	12,47	5,70	0,89	18,71
1 minute	2,53	0,88	37,93	3,49	1,17	50,4	5,28	0,47	9,77	5,45	0,64	13,30
3 minutes	2,56	0,97	39,65	3,47	1,15	49,5	5,31	0,50	10,30	5,36	0,55	11,40
5 minutes	2,69	0,98	42,24	3,56	1,24	53,4	5,12	0,44	9,14	5,42	0,61	12,68

Notations: $\overline{D}_p$ – valeur moyenne du diamètre pratique d'étalage; $\Delta\overline{D}_p$ – l'accroissement du diamètre pratique d'étalage dans la valeur absolue et en pourcentage envers le diamètre pratique des preuves-témoin.

Poursuivant les résultats obtenus, on constate aussi dans le cas de l'étalage du liquide adhésif sur le substrat de caoutchouc thermoplastique, un accroissement de pourcentage du diamètre de la surface d'étalage comprise entre 10-20%.

3. L'influence du traitement superficiel sur la résistance de la jonction par adhérence. En poursuivant l'influence de l'halogénation des surfaces de caoutchouc sur la résistance du raccord par adhésion, on a fait des expérimentations de rupture et des raccords réalisés sur des substrats effilochés et sur des substrats effilochés et traités avec du "Halogène H", respectivement "Primer XG".

La comparaison des résistances au détachement des raccords, après vingt-quatre heures depuis leur réalisation (tableau 2), montre la supériorité de l'halogénation de la surface du caoutchouc thermoplastique, vis-à-vis de la surface effilochée (la résistance à la rupture accroît avec 15-37%).

Tableau 2

La nature de l'adhésif	Substrats racordés	Le traitement	$\overline{R}$ (N/mm)	S^2	S	C_v (%)	R_{max} / R_{min}	$\Delta\overline{R}$ (N/mm)	$\Delta\overline{R}$ (%)
Aderom 551 et 5% Harter Fx	Caoutchouc thermoplastique-cuir synthétique	le témoin	2,69	0,0022	0,0475	1,70	1,04	–	–
		l'effacement – Halogène H	3,22	0,0105	0,1024	3,18	1,22	0,53	19,70
		l'effacement – Primer XG	3,09	0,0132	0,1149	3,72	1,11	0,40	14,86
	Caoutchouc thermoplastique-cuir naturelle	le témoin	4,30	0,0357	0,1890	4,39	1,53	–	–
		l'effacement – Halogène H	5,87	0,1513	0,3890	6,63	1,25	1,57	36,51
		l'effacement – Primer XG	5,24	0,0681	0,2611	4,98	1,17	1,10	26,57

La modification des proprietés superficielles par l'halogénation des substrats de caoutchouc a conduit à l'accroissement de l'adhérence du liquide adhésif, dans le cas de l'emploi du produit "Halogène H".

4. Conclusions. i. Dans le cadre du travail ici présent ou a établi l'efficacité de l'emploi de l'agent d'halogénation roumain "Halogène H" au traitement chimique des semelles de caoutchouc en vue de leur adhérence à la chaussure.

ii. L'effet positif du traitement superficiel avec le produit "Halogène H" se manifeste aussi dans le processus de l'étalage par l'accroissement du diamètre de la surface d'étalage avec 12-20%, ainsi que par l'amélioration de la résistance du racord par adhérence, l'accroissement de la résistance du raccord étant de 20-30% comparatif à celle des preuves – témoin.

iii. En analysant comparativement l'agent d'halogénation obtenu par la chloramine B – "Halogène H" et l'agent d'halogénation "Primer XG", on constate que les résultats obtenus sont parfaitement comparables; donc on peut l'employer couramment dans les fabriques de chaussure au traitement chimique des semelles de caoutchouc thermoplastique.

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Institut Polytechnique, Jassy,
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ASPECTE CU PRIVIRE LA INFLUENŢA TRATAMENTULUI SUPERFICIAL CU PRODUSUL ROMÂNESC "HALOGEN H" ASUPRA REZISTENŢEI ÎMBINĂRII PRIN LIPIRE

(Rezumat)

Se prezintă efectul tratamentului superficial al cauciucului termoplastic cu agentul de halogenare românesc "Halogen H" asupra etalării şi aderenţei adezivului poliuretanic la lipirea tălpii pe încălţăminte.

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Secţia VIII
TEXTILE. PIELĂRIE

RESEARCHES ON THE SURFACE MODIFICATIONS OF POLYESTERIC FIBRES UNDER PLASMA ACTION

BY

FLORIN VĂLU, DORU RADU and LILIANA STOICHIŢESCU

The plasma chemistry produces a vivid interest for various industrial branches offering thus, new technological ways which are superior to the classical procedures of raw materials processing. Although the studies have been mainly directed towards the elementary processes that take place in the polymerization and synthesis reactions as well, a remarkable progress has been recorded in the latest years in the field of synthetic and natural polymers processing up to the industrial stage.

1. Considerations on Some Characteristics of Plasma Media. The accidental free electrons, accelerated in electrical field, in certain conditions of gas pressure inside the reaction enclosure, can generate the plasma effect as a consequence of the particles ionization from that medium. Thus, the ionization degree may vary from relatively small values, in the case of cold plasmas – subject we are dealing with in this paper – up to extremely high values. As a result if these ionizations, the electrons are further on accelerated while the processes, getting the apearance of a chain development, promote at the same time a remarkable increase of the electric current.

The average energy values as well as those of the electrons density in the cold plasma accomplished by electrical discharges at low pressures are comprised between 1 and 10 eV and 10^9-10^{12} molecules/cm^3, respectively. in these conditions the electrons temperature is different from the gas one, the ratio T_e/T_g varying between 10-10^2. Thus, in plasma media, chemical reactions may be got even in the cases of easy degradable materials because the gas temperature presents values close to those of the surrounding medium while the electrons have enough energy for determining chemical reactions.

The action of electrical or magnetical field on the gas molecules placed in a discharge tube by means of the accelerated free electrons consist in a series of elementary processes, leading, in their turn, to the ions, atoms, radicals, exited atoms and molecules as well as electrons and photons formation.

The most probable elementary processes which may take place in cold plasma are the following ones:

$$AB + e^- \rightarrow AB^- \qquad (1)$$

$$AB^- \rightarrow A + B^- \tag{2}$$

$$AB + e^- \rightarrow A + B + e^- \tag{3}$$

$$AB + e^- \rightarrow AB_+^+ + 2e^- \tag{4}$$

$$A_xB_y \rightarrow \begin{cases} A_xB_{y-1} + B. \\ A_xB_{y-2} + 2B. \\ A_xB_{y-3} + 3B. \end{cases} \tag{5}$$

$A_xB_y \xrightarrow{h\nu}$ mondo and polyfunctional radicals.

The transformation (1) may take place as a consequence of cold electrons collisions, i.e. with those having a diminished energetic, contribution when it is more probable the formation of the negative ions. The latter ones (the negative ions) can dissociate, generating both neutral particles from the electrical viewpoint and negative ions, as well (2). On the other hand, the high energy electrons – according to (3) – can divide the molecules while the already formed negative and positive ions by means of neutralization or reorganization may lead to the appearance of new molecular, atomic, ionic or radical species. The electrons with a much higher level energy are able to extract electrons out of the molecules, forming thus cations according to (4), that have a short life and which, due to division, give birth to neutral or ionic compounds. According to a series of transformations of the type (5), during these processes, there exist possibilities of mono and polyfunctional radicals direct formation [1, 2, 3].

2. The Experimental Part

2.1. The Equipment Employed. The equipment used for getting the plasma with the view of the polyesteric treatment is made up of: a reactor where the energy of the high frequency electric field is transmitted by means of some external electrodes, an installation for getting the vacuum as well as of samples supporting devices. The high frequency electric current generator has the following features: frequency = 13.56 MHz; anodic current between 0-1000 mA; grid current between 0-200 mA; power = 0-5,5 kW and the external electrodes made up of inoxidable steel having the dimensions 1,5 × 760 × 320 mm.

2.2. The Temperature Range Estimation. One of the main effects got in plasma media is the thermal one whose value offers the possibility of fabric maintainance. Depending on the treatment duration, the final temperature of the gas inside the reactor has been measured while the air has been used as a working medium. The data are shown in Table 1.

It comes out from the data presented in Table 1, that the treating time in plasma has a cumulative effect on the temperature of the gasinside the reactor. The obtained values point out the influence of the three parameters i.e. pressure, electrical tension (voltage) and time for getting the caloric effect. Thus, the pressure is considered to be the parameter with the highest influence on the thermal effect

Table 1

The plasma temperature, function of the working parameters.

No.	Treating duration (sec.)	Pressure (torr)		$U_{work.}$ (V)	I_{anodic} (A)	I_{grid} (A)	Temperature (°C)
		Upstream	Downstream				
1.	180	6	0.7	100	0.2	0.04	71
2.	840	5	1.5	100	0.2	0.04	81
3.	180	7	2	140	0.2	0.03	105
4.	180	8	3	140	0.2	0.03	107
5.	60	8	2	180	0.3	0.05	79
6.	180	7.1	1	180	0.28	0.05	100

as a consequence of the increasing or decreasing of the collision possibilities of the particles among themselves from the average free distance variation viewpoint. Pressure with values exceeding 4 torrs dowstream lead to temperature over 200°that make it be unusable for the textile field. Although the voltage commands the absorption power by means of the anodic current, it has nevertheless a smaller influence as a result of the condenser load which remains relatively constant during the testing time. Depending on the three parameters values, temperature ranges may be obtained in accordance with the aims we had in view. It comes from the presented data that in the experimental conditions mentioned above, temperatures lower than 100°may be obtained which favours the possibility of maintaining the textile fabric integrity even in the cases when materials with a high sensitivity to high temperatures are involved.

2.3. Estimation of The Textile Fabric Integrity. The textile fabric, (100% polyesteric woven samples having a 4.7 Tex fineness and 6×50 cm.dimensions) was exposed to the air plasma action. The accomplished determinations and analyses had in view and watched the modifications appeared on the warp yarns.

2.4. The Average Polymerization Degree. After 10 successive extractions in ethylic ether, in a Soxhlet, the samples were dissolved in a solution of phenol:C_2C_4 in ratio 1:1. The average polymerization degree was determined with the help of an Ubbelohde viscosimeter, having K = 0.01012 and a thermostat at 20°C. The data are presented in Table 2.

It comes out the above presented data that the average polymerization degree is higher in the cases when the polyester was treated in plasma in comparation with the standard samples; this fact presumes that ferquent reticulation appears, as a consequence of the macroradicals formed on fibre.

2.5. The Dissolving Critical Time. The dissolving critical time has been determined for sets of 20 yarns in phenol thermostated at 60°C. For tensioning the yarns a calibrated weight of 1 gram was used. The obtained aversge values are presented in Table 3.

The obtained experimental results are in accordance with the average polymerization degree, having increased values in comparison with the standard sample;

Table 2

The average polymerization degree for polyesteric woven treated in air plasma.

No.	Treading time (sec.)	Pressure (torr)		$U_{work.}$ (V)	I_{anodic} (A)	I_{grid} (A)	The average time of flowing (sec.)	* (%)
		Upstream	Downstream					
SOLVENT							405	
STANDARD							428	
1.	180	12	0.7	180	0.1	0.05	507	+344
2.	180	10	0.9	140	0.1	0.025	497	+317
3.	240	10	0.95	160	0.1	0.035	509	+348
4.	120	10	0.85	170	0.1	0.04	496	+313
5.	60	10	0.9	180	0.1	0.04	494	+307

* Modifications of the average polymerization degree in comparation with the standard

Table 3

The dissolving critical time values.

No.	Treating time (sec.)	Pressure (torr)		$U_{work.}$ (V)	I_{anodic} (A)	I_{grid} (A)	Thedissolving critical time (sec.)
		Upstream	Downstream				
STANDARD							80
1.	180	12	0.7	180	0.1	0.05	117
2.	180	10	0.9	140	0.1	0.025	186
3.	240	10	0.95	160	0.1	0.035	181
4.	120	10	0.85	170	0.1	0.04	186
5.	60	10	0.9	180	0.1	0.04	158
6.	240	10	0.7	180	0.1	0.04	115
7.	600	10	2.25	180	0.1	0.04	145

this fact confirms the reticulations appearance as a result of plasma treatments. Under the circumstances of maintaining the working parameters at relative constant values (e.g. the values of power and pressure, a.s.o.) it has been tested the influence of air plasma treatment duration. The obtained data are presented in Table 4.

Out of the presented data, it may be noticed that after a certain plasma treating duration, the values of dissolving critical time decrease, fact which might be due to the plasma corroding effect which thus becomes preponderant in comparison with reticulation reactions. It might be, the life duration influence of the macroradicals existing on the catene under the plasma generating conditions, too. Within the accomplished experiments changes of some characteristic values in time were noticed. Thus, the dissolving critical time at different durations has been determined from the plasma treating moment. These data are shown in Table 5. The above presented values point out the increasing of the dissolving critical time in comparison with duration related to the time between the plasma treatment and

Table 4

The treating duration influence on the dissolving critical time.

No.	Treating duration (sec.)	Pressure (torr) Upstr.	Pressure (torr) Downstr.	$U_{work.}$ (V)	I_{anodic} (A)	I_{grid} (A)	The dissolving critical time (sec.)	Temperature (°C)
STANDARD							149	
1.	120	12	2	120	0.2	0.02	213	40
2.	300	6	0.75	120	0.2	0.01	258	43
3.	480	8	0.15	120	0.2	0.02	255	45
4.	660	8	0.25	120	0.1	0.02	283	60
5.	840	8	0.25	120	0.1	0.02	259	85

Table 5

The variation in time of the dissolving critical duration.

No.	Treating duration (sec.)	Pressure (torr) Upstr. (torr)	Pressure (torr) Downstr. (torr)	$U_{work.}$ (V)	I_{anodic} (A)	I_{grid} (A)	The dissolving critical time (days) 2 (sec.)	3 (sec.)	4 (sec.)	7 (sec.)	8 (sec.)
1.	1800	12	0.5	100	0.1	0.03	283	348	363	379	384

the determination accomplishment.

2.6. The Hydrophilie Determination by Means of Capillarity Test. In the Tables 6 and 7 the hydrophilie values, are presented function of the working parameters and of duration, respectively, from the presented values it comes out that the air plasma treatments confer an increased hydrophilie to the polyesteric fabric in comparison with the standard. The radicals formed as a result of the plasma action change the polymer surface properties, leading to the favourable result of water sorption increasing. The water sorbtion affect is dependent on the treatment duration and decreases in time reaching an equilibrium value which is superior to the standard.

Table 6

The variation in time of the polyesteric hydrophilie.

No.	Treating duration (sec.)	Pressure (torr) Upstr. (torr)	Pressure (torr) Downstr. (torr)	$U_{work.}$ (V)	I_{anodic} (A)	I_{grid} (A)	Capillarity (cm.) in time 2 (days)	3 (days)	4 (days)	7 (days)	8 (days)
1.	60	8	2	180	0.3	0.05	9.6	8.9	7.8	7.5	7,4
2.	180	8	3	140	0.2	0.03	9.4	8.5	8.1	8.3	8.1
3.	180	6	0.7	100	0.2	0.04	10	8.8	7.8	6.9	7.5
4.	1080	5	1.5	100	0.2	0.03	9.7	9.1	8.3	7.2	7.2

3. Conclusions. The plasma thermal effect is function of the working pressure and of the value of the applied electrical parameters while the treatment duration

Table 7

The variation of polyesteric hydrophilie function of the treatment duration.

No.	Treating duration	Pressure		$U_{work.}$	I_{anodic}	I_{grid}	Capillarity after 30 minutes
		Upstr.	Downstr.				
	(sec.)	(torr)	(torr)	(V)	(A)	(A)	(cm.)
1.	120	12	2	120	0.2	0.02	7.85
2.	300	6	0.75	120	0.2	0.01	12.7
3.	480	8	0.15	120	0.2	0.02	13.1
4.	660	8	0.25	120	0.1	0.02	13.85
5.	1080	8	0.25	120	0.1	0.02	14.5

has a cumulative effect on the temperature increase of the gas from plasma.

The experimental equipment employed is able to get the fit parameters necessary for achieving some controlled temperatures under or over 100°C.

The fabric integrity is not at all affected, fact which is confirmed by the polymerization degree as well as by the dissolving critical time determination; on the contrary, in such cases, the polymer reticulations appear.

The plasma modifies, in a favourable manner, the polymer surface characteristics pointed out by the hydrophilie determination. The hydrophilie values are dependent on the duration and on the treating medium characteristics, as well, and it is attenuated in time, reaching an equilibrium value.

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CERCETĂRI PRIVIND MODIFICĂRILE DE SUPRAFAŢĂ ALE FIBRELOR POLIESTERICE SUB ACŢIUNEA PLASMEI

(Rezumat)

Lucrarea abordează tratamentele în plasmă de aer asupra unei ţesături din poliester 100%, Sînt evidenţiaţi factorii de control care determină efectul termic al gazului din plasmă.

Hidrofilia ţesăturii tratate în plasmă creşte funcţie de durata de tratare şi de parametrii energetici ai plasmei. În timp, hidrofilia scade atingînd o valoare de echilibru superioară probei martor. Fibrele poliesterice suferă un efect de reticulare pus în evidenţă prin determinări ale gradului de polimerizare şi ale timpului critic de dizolvare.

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IMPROVING THE ANIONIC-DYE PRINTING OF POLYAMIDIC TEXTILES

BY

ROMEN BUTNARU, RODICA MUREŞAN and AUGUSTIN MUREŞAN

1. Introduction. In printing polyamidic textiles, anionic-dyes (acid, direct, premetallized dyes) are generally used. They allow higher degrees of light and wet-treatment fastness. In this case, the print pastes contain, besides the dye, printing gum, acid or acid producers, solvents and hydrotropic compounds which favour the loosening of the dye and increase the fibre accessibility [1]. Actually, it is necessary to know the upgranding thresholds of the hydrotropic compounds, as any excess may cause undesirable side effects [2].

Temperature and duration of the cure are also of great importance in dyestuff fixing. Thus, a temperature of 100-102°C and a 20-30 minutes time cure are regarded as satisfactory, whereas exceeding these limits may cause undesirable changes in shade [3]. Nevertheless, there are some direct and acid dyes for which a 10 minutes time ageing is enough to secure a good fastness [1].

2. The Experimental Section. The aim of this study was to determine the optimum conditions for the addition of urea, used as a solvent and a hydrotropic compound for the temperature and the ageing duration in direct-dye printing of polyamidic textiles. For this purpose, we have used a monofilament relon, scoured and fixed under industrial conditions, on which we applied a print paste containing:

50 g	dye
30 g	ammonia sulfate
x g	urea
z g	Indalka PA-3 printing gum
t g	water.
1000 g	paste

The dyes we tested were: Direct Yellow E.P.L., Direct Red 4A (C.I.Direct red 44) and Direct Blue L2R (C.I. Direct Blue 71). After printing, the cloth was dried, then exposed to an ageing process, using different temperatures and durations, and then washed in cold water, a 3 g/l sulphatized fatty alcohol liquor, then in hot water. Finally, it was retreated with Romatan FST,2 g/l.

In order to accomplish our task and to diminish the number of experiments as much as possible, we used the multiple regression method, taking into account the following variables:

X_1 – the concetration of urea in the print paste, expressed in g/kg paste;

X_2 – the ageing temperature, in °C;

X_3 – the duration of cure, in minutes.

The variation limits of these variables and their coding are presented in Table 1.

Table 1

The variation limits of variables

	−1.682	−1	0	+1	+1.682
X_1	0	16	40	64	80
X_2	100	104	110	116	120
X_1	10	16	25	31	40

The twenty experiments were routed over an experimental schedule shown in Table 2. We studied the following indices for the printed textiles:

– the colour intensity (Y_1);

– the degree of penetration (Y_2), both measured by electrophotocolourimetry, and, finally

– the sharpness of the pattern, evaluated by ganging the maximum prominence preserved by the paste according to a certain pattern [4,5].

Processing these data and excluding the insignificant coefficients, we obtained the regression equations which allowed us to analyse graphically a relation between the tested indices and the parameters of the process (Figs. 1-9).

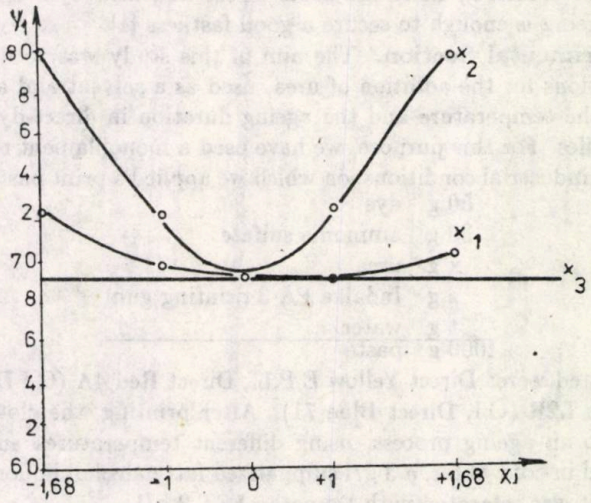

Fig. 1

Table 2

The experimental plan and results

Nr. exp	X_1	X_2	X_3	Direct Yellow EPL			Direct red 4A			Direct blue L2R		
				Y_1	Y_2	Y_3	Y_1	Y_2	Y_3	Y_1	Y_2	Y_3
1.	−1	−1	−1	72	70.8	99	52.3	68	99	21.85	74	97
2.	+1	−1	−1	72	65.27	99	42.5	70.08	94	26.5	64.44	93
3.	−1	+1	−1	67	68.32	97	52	72.21	98.4	37.3	65.5	98
4.	+1	+1	−1	70	72.21	100	75	70	95	77.35	0	98
5.	−1	−1	+1	75	62.77	100	48	77.77	98	78.3	0	99
6.	+1	−1	+1	73	76.38	100	46	77.77	98	29.6	72.2	95
7.	−1	+1	+1	76.3	75	99	51	86.1	85.5	10	75	100
8.	+1	+1	+1	73	87.5	99	45.15	73.6	98	8.5	79.16	93
9.	−1.682	0	0	74.4	64	99	54	86.1	99	53	77	100
10.	+1.682	0	0	70.35	62.5	99	45	86.1	95	31	71.1	99
11.	0	−1.682	0	80.7	0	97	47	76.38	100	77.2	0	97
12.	0	+1.682	0	82	0	99	47	69.43	97.6	56	80	99
13.	0	0	−1.682	76	64	96	51	74.99	95.5	12	70	97
14.	0	0	+1.682	68	61	98	42.35	75	96	7.5	72.2	92
15.	0	0	0	67.5	66	99	46	78	99	9	92	94
16.	0	0	0	69	70	96	48	81.6	98	14.5	72.2	92
17.	0	0	0	70	68	98.7	47.5	80	97	10	82	92.5
18.	0	0	0	72	65	95	48.7	75	98.5	9.5	75	95
19.	0	0	0	66	67	97.7	48.2	76	96.8	11	70	93
20.	0	0	0	68.5	66	98	49	79	97.7	10.5	80	94

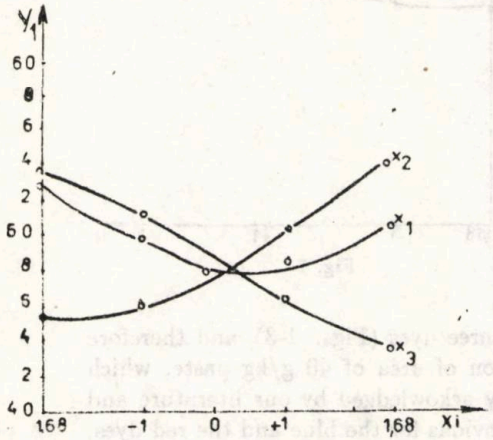

Fig. 2

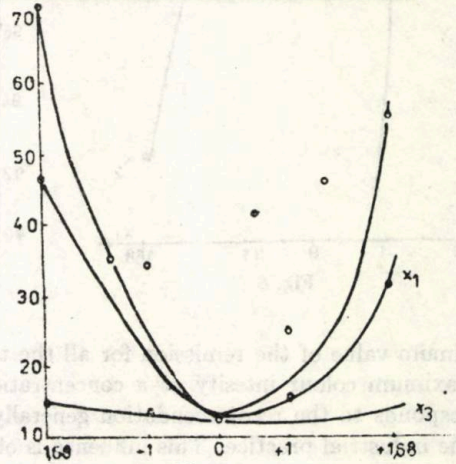

Fig. 3

3. Discussion on the Results

3.1. The Colour Intensity. The addition of urea in the print paste (X_1) influence upon the intensity, and this influence is expressed by remission. One can notice a

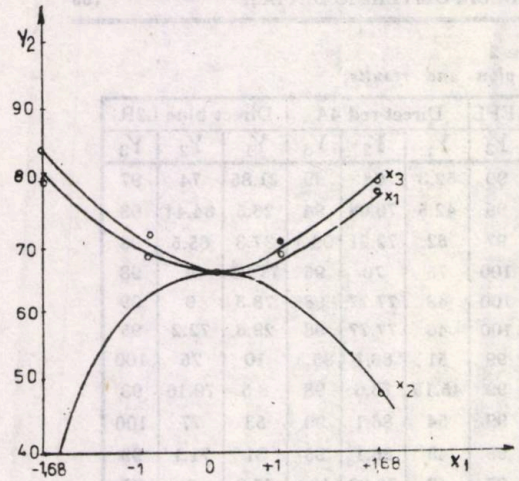

Fig. 4

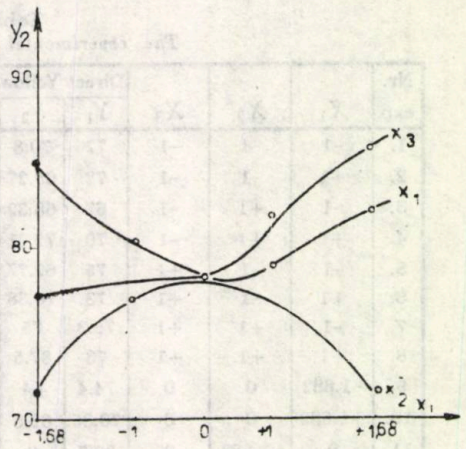

Fig. 5

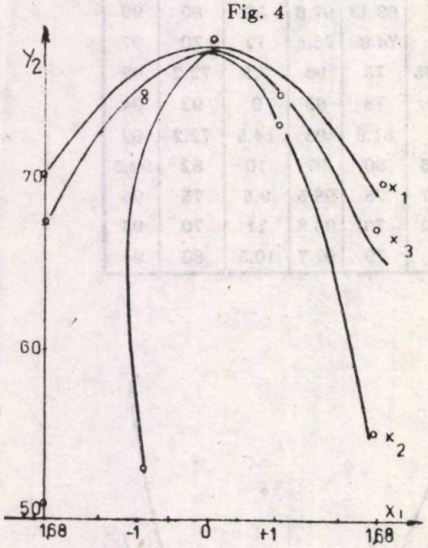

Fig. 6

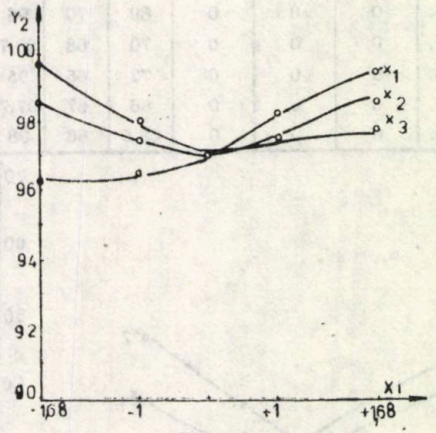

Fig. 7

minimum value of the remission for all the three dyes (Figs. 1-3), and therefore a maximum colour intesity at a concentration of urea of 40 g/kg paste, which corresponds to the recommendation generally ackowledged by our literature and to the industrial practice. This influence is obvious for the blue and the red dyes, and less important for the yellow one, where the minimum is less marked, though it exists.

As far as the ageing temperature (X_2) is concerned, its influence upon the dyes we have studied is real. Thus, we can ascertain an optimum value of 110°C, that is

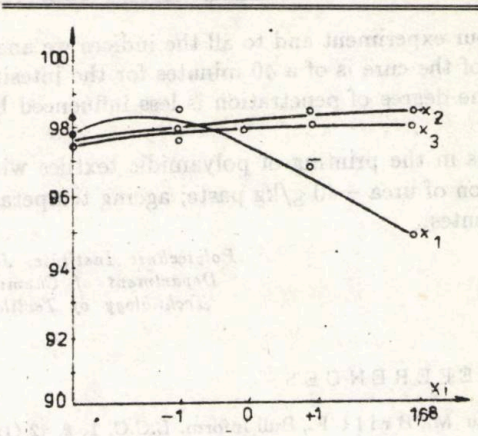

Fig. 8

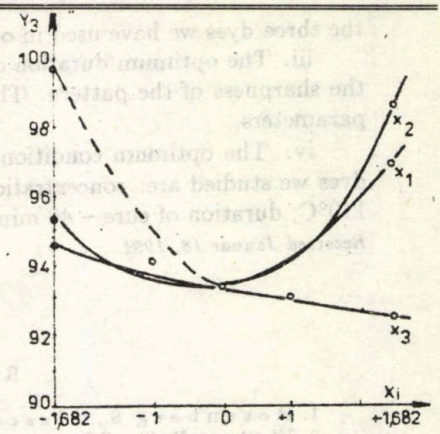

Fig. 9

slightly overheated steam. In this case the influence is also different for the various dyes. It is most obvious for the blue dye, for the red one, and quite unimportant for the yellow one. The influence of the duration (X_3) upon the intensity shows that, for the red dye, the necessary duration of the curve is more extended – it has to be of about 40 minutes – wheres for the yellow and for the blue ones, a 10-15 minutes time cure proves to be quite enough.

3.2. The Sharpness of the Pattern. For a concentration of urea of 40 g/kg paste, only with the blue dye a maximum sharpness of the pattern is allowed. With the other two dyes, one can ascertain only minimal values of this index, extremely low. For a change, just as for the previous index, a maximum value is to be seen for a 110°C temperature with all the three dyes (Figs. 4-6).

As far as duration is concerned (X_3) the yellow dye behaves very much like the red one, displaying two minimum values of the sharpness of the pattern – one for a 10 minutes duration – while the blue dye shows one single maximum value, at a 25 minutes duration.

3.3. The Degree of Penetration. Just like the colour intensity, the degree of penetration is measured in terms of remission, and a minimum value of the latter denotes an efficient degree of penetration. For the yellow and blue dyes, minimum values of this index are obtained at a concentration of urea of 40 g/kg paste and at a 110°C temperature, that is within parameters which have identical values with those which lead to a maximum value of the colour intensity. The duration of the cure has no significant influence upon these dyes. As for the red one, no parameter induces any important minimum or maximum values (Figs. 7-9).

4. Conclusions. i. The addition of urea, an extremely necessary auxiliary in anionic-dye printing of polyamides, modifies the quality of the printing. We have found an optimum concentration of urea (about 40 g/kg paste) which is a function of the structure of the dye and to the purpose aimed at (intensity, sharpness, degree of penetration).

ii. The optimum value of the ageing temperature (110°C) is the same for all

the three dyes we have used in our experiment and to all the indices we analysed.

iii. The optimum duration of the cure is of a 40 minutes for the intesity and the sharpness of the pattern. The degree of penetration is less influenced by this parameters.

iv. The optimum conditions in the printing of polyamidic textiles with the dyes we studied are: concentration of urea – 40 g/kg paste; ageing temperature – 110°C; duration of cure – 40 minutes.

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OPTIMIZAREA IMPRIMĂRII MATERIALELOR TEXTILE POLIAMIDICE CU COLORANŢI ANIONICI

(Rezumat)

Se prezintă rezultatele obţinute la imprimarea materialelor textile poliamidice cu trei coloranţi direcţi în prezenţa ureei ca substanţă hidrotropă. S-a stabilit influenţa cantităţii de uree folosită, a temperaturii de aburire şi a duratei acesteia asupra următorilor indici de caracterizare a calităţii procesului de imprimare: intensitatea culorii, precizia desenului, gradul de pătrundere.

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TEXTILE. PIELĂRIE

MODIFICATION SUPERFICIELLE DES FIBRES POLYESTER POUR L'AMÉLIORATION DES EFFETS DES TRAITEMENTS DE FINISSAGE SUPÉRIEURS

PAR

ELENA ILIESCU, ANCA CHELARU, IULIA BĂLĂU-MÎNDRU, VIRGIL MEDVICHI et MARICEL TAŞCĂ

1. Introduction. Lors du finissage des produits de fibres synthétiques il est nécéssaire une antistatisation permanente qui résiste aux lavages répetés, pour l'élimination des inconvénients qui concernent le chargement électrostatique pendant l'utilisation du produit respectif. Les substances d'antistatisation permanente sont des polymères provenus des monomères de groupes polaires qui, à l'àide d'un agent de réticulation, se transforme en résines tridimensionelles qui forment des pellicules à la surface de la fibre.

Le problème qui se pose est de réaliser une pélicule qui, outre l'effet antiélectrostatique, soit adhérente et qu'elle résiste aux actions mécaniques et solubilisantes. Les forces d'adhésion entre l'apprêt antistatique et les fibres peuvent être liaisons de covalence ou forces physiques [1,2,3,4].

Dans le cas de l'application des substances antistatiques par foulardage sur des fils polyester, grâce à leur surface luisante, la quantité de solution sur la matière est trop réduite, ce qui mène à la protection antistatique insuffisante, dans des conditions de sollicitation du produit.

On peut réaliser l'accroissement de l'adhérence des produits d'antistatisation permanente en modifiant la surface des fibres, c'est-à-dire en créant des pores. Dans le cas des fibres polyester, on obtient les surfaces poreuses par le traitment alcalin, dans des conditions différentes [5].

2. Partie expérimentale et résultats. Dans une première étape, les recherches ont poursuivi d'établir les conditions optimales de traitement alcalin qui assurent l'apparition des pores en même temps que le maintien des caractéristiques physiques et mécaniques dans un domaine soumis à la modification.

On a réalisé les traitements alcalins sur les fils polyester 167/32 dtex, avec des solutions de NaOH, dans les conditions suivantes:

– la concentration de NaOH = 20, 30, 40, 50 g/l
– la durée = 15, 30, 60 min
– la température = 100°C

Après le traitement, on a neutralisé les échantillons avec une solution 0,1 N de HCl, pendant 10 min., après quoi on appliqué un lavage de 10 min. à l'eau distillée, ensuite le séchage et le conditionnement.

On a déterminé pour les échantillons soumis au traitement alcalin: la perte de masse et la résistance à la rupture. Les résultats sont présentés dans les figures 1-2.

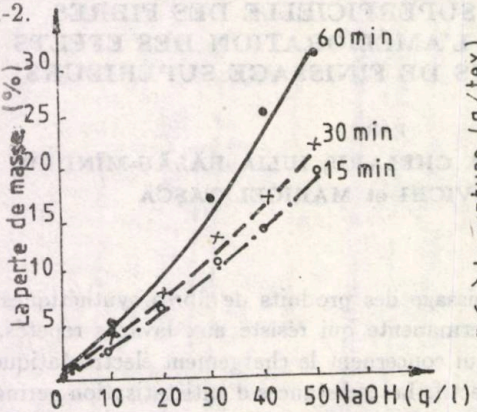

Fig. 1.– La perte de masse fonction de concentration et de durée du traitement

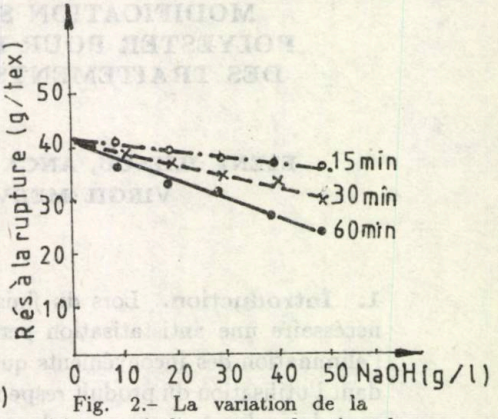

Fig. 2.– La variation de la résistance à la rupture fonction de concentration et de durée du traitement

On a mis en évidence les modifications de surface par des images obtenues en microscopie électronique pour les fils soumis au traitement alcalin dans des conditions différentes. On remarque l'accroissement de la porosité fonction de concentration et de durée de traitment.

Si on tient compte des résultats obtenus, on choisit comme variante convenable le traitement dans les conditions suivantes:

concentration NaOH = 30 g/l, durée = 30 min.

La perte de la masse est de 15% et la résistance à la rupture diminue avec 20%.

Ensuite on a observé l'effet d'un produit d'antistatisation (AES) synthétisé en laboratoir, à base d'acide adipique et polyethylèneglycol 400, sur les fils polyester soumis ou non au traitement alcalin. On a travaillé en deux variantes d'application avec les doses:

– échantillon A: – 6 g/l AES
– 6 g/l triméthylènetétramine
– 1 g/l acide acétique
– échantillon B: – 6 g/l AES
– 6 g/l triméthylènetétramine
– 1 g/l acide acétique
– 2 g/l Romacrile

La technologie d'application réside dans le traitement avec le produit, 5 min. à 40°C, suivie de la condensation des produits, 10 min. à 170°C. L'effet antistatique du traitement, évalué par la réduction à moitié du temps de la charge électrique, est présenté dans le tableau 1.

Tableau 1

Le temps de réduction à moitié ($t_{1/2}$), fonction de variante de traitement

Variante	PES nonmodifié		PES modifié	
	avant le lavage	après le lavage	avant le lavage	après le lavage
Preuve A	3	42	3	14
Preuve B	3	35	3	10

On observe une diminution du temps de réduction à moitié pour les échantillons soumis au traitement alcalin, après lavage, comparativement aux échantillons non-traités, pour les deux variantes de travail.

3. Conclusions. Les résultats obtenus ont prouvés qu'un prétraitement alcalin des fils polyester a comme effet une amélioration des effets des traitements d'antistatisation permanente.

En mêmme temps, les conditions de prétraitement maintiennent les paramètres physiques et mécaniques des fibres dans des limites admissibles des modifications.

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MODIFICAREA SUPERFICIALĂ A FIBRELOR POLIESTERICE ÎN VEDEREA ÎMBUNĂTĂŢIRII EFECTELOR TRATAMENTELOR DE FINISARE SUPERIOARĂ

(Rezumat)

Lucrarea prezintă unele posibilităţi de îmbunătăţire a efectelor tratamentelor de antistatizare permanentă a fibrelor poliesterice.

O creştere a aderenţei produselor de antistatizare a fost realizată prin creşterea porozităţii suprafeţei fibrelor poliesterice prin tratamente alcaline.

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TEXTILE. PIELĂRIE

RESEARCHES UPON THE EFFICIENCY OF SEVERAL ORGANIC SOLVENTS IN EXTRACTING WAXES AND PARAFFIN FROM COTTON YARNS

BY

ELIZA PUŞCAŞ, ANDREI BERTEA and ANIŞOARA BERTEA

1. Introduction. The maturised cotton fibre comprises different components. The external primary layer, which accounts for only 1% of the fibre diameter, consists of cellulose and large quantities of proteins, waxes and mineral salts that are contained in the total cross-section of the fibre. The secondary layer, which accounts for over 90% of the mass of the maturised fibre, consists of about 90% cellulose. The lumen at the center of the fibre contains small portions of proteins and mineral salts.

The cotton wax consists essentially of higher alcohols, higher fatty acids and esters of the latter, hydrocarbons and cholesterol derivats [1].

Many suppositions have been made concerning the waxy substances distribution in cotton fibres. Taking into consideration the ability of wax to decrease the abrasion coefficient, in an early period it has been stated that cotton fibre has got a 15-25 μ thick waxy cover [2]. Subsequent studies specify that an organic bond could exist between the primary layer and the waxy cover, realised through phosphorus containing pectins [3].

Other researches conclude that the waxy substances are caught in a complicated complex made of cellulose and its natural admixtures. The Ca and Mg ions play an important role in the stability of this complex [4].

For many years, the presence of the waxy substances in cotton fibres was considered to be the only reason for the hydrophobia of cotton, but more recent papers proved that no link exists between the dewaxing of cotton and the increasing of the hydrophily. This was confirmed by increasing the hydrophily using a sodium chlorite treatment, without affecting the wax content [4]. A wide range of solvents have been used for the extraction of the waxy substances of cotton [5, 6, 7].

In the present paper we shall try to estimate the capacity of some organic solvents to extract waxy substances and paraffin (the latter deposited on the fibre

in the mechanical processing) from cotton yarns.

2. Experiments. The tested solvents have been grouped in two categories according to their chemical structure:

Group I – solvents with polar structure: ethylic alcohol, isopropyl alcohol, butyl alcohol.

Group II – solvents with non-polar structure: benzene, toluene.

The sorts of yarns studied are presented in Table 1.

The waxy substance determination has been performed according to STAS 7690/84, using 5 samples. Two samples have been used to determine the moisture content, according to STAS 6217/82, and the other three have been used for the determination of the waxy substance content, using a Soxhlet aparatus and the above-mentioned solvents.

Table 1

The characteristics of the studied yarns

No.	Fibre composition	Paraffin		Nm
		Treated	Untreated	
1	Cotton/viscose staple fibre 67/33	+		60/1
2	Cotton/viscose staple fibre 67/33		+	60/1
3	Viscose staple fibre 100%	+		16/1
4	Viscose staple fibre 100%		+	16/1
5	Cotton/viscose staple fibre 67/33	+		54/1
6	Cotton/viscose staple fibre 67/33		+	54/1
7	Cotton 100%	+		40/1
8	Cotton 100%		+	40/1
9	Cotton 100%	+		60/1
10	Cotton 100%		+	60/1
11	Cotton/viscose staple fibre 83,4/16,6	+		54/1
12	Cotton/viscose staple fibre 83,4/16,6		+	54/1
13	Cotton/viscose staple fibre 33/67	+		60/1
14	Cotton/viscose staple fibre 33/67		+	60/1
15	Cotton/polyester 67/33	+		54/1
16	Cotton/polyester 67/33		+	54/1
17	Cotton/polyester 33/67	+		54/1
18	Cotton/polyester 33/67		+	54/1
19	Polyester/viscose staple fibre 50/50	+		60/1
20	Polyester/viscose staple fibre 50/50		+	60/1
21	Cotton/viscose staple fibre 83,4/16,6	+		60/1
22	Cotton/viscose staple fibre 83,4/16,6		+	60/1

Results have been expressed in the following three ways, all stipulated by STAS 7690/84:

I. Extractable substance content related to dry material weight C_{gu}, calculated with the formula:

$$C_{gu} = \frac{m_1}{m} 100, \quad \%$$

m_1 – the weight of the dried residue in the extraction flask, g;

m – the weight of the sample before the extraction, g.

II. Extractable substance content related to a material with a moisture content equal to the regain, calculated with the formula:

$$C_{gr} = \frac{m_1}{m \cdot \frac{100+u_c}{100}} \cdot 100, \quad \%$$

u_c – the regain according to STAS 6217/82, %.

Table 2

Extractable substance content related to the dry material

	Extraction with				
	polar structure solvents			non polar str. solv.	
No.	ethylic alc.	isopropyl alc.	butyl alc.	benzene	toluene
1	1.58	0.97	0.76	1.13	1.15
2	1.48	0.97	0.74	0.52	0.70
3	1.00	0.40	0.55	0.89	0.99
4	0.35	0.18	0.22	0.32	0.25
5	1.97	0.76	0.75	1.69	1.73
6	1.16	0.48	0.50	0.46	0.55
7	2.30	1.40	0.92	1.87	2.76
8	1.98	1.10	0.72	0.48	0.50
9	1.46	0.95	0.89	0.95	1.30
10	1.11	0.72	0.72	0.37	0.66
11	1.83	1.18	0.69	1.45	2.25
12	1.50	0.95	0.54	0.27	1.18
13	1.80	1.48	1.37	1.30	1.80
14	1.58	0.87	1.00	0.10	0.70
15	2.00	1.86	1.32	1.56	1.90
16	1.74	1.09	1.01	0.21	0.82
17	1.00	0.87	0.40	0.95	1.06
18	0.94	0.57	0.30	0.11	0.77
19	0.45	0.35	0.27	0.90	0.99
20	0.30	0.31	0.20	0.15	0.45
21	2.00	0.94	1.00	1.40	2.98
22	1.87	0.78	0.83	0.36	0.99

III. Extractable substance content related to the dryed and extracted material weight C_g, calculated with the formula:

$$C_g = \frac{m - m_2}{m_2} \cdot 100, \quad \%$$

m_2 – the weight of the sample after the extraction, g.

The results are shown in Tables 2,3 and 4.

Table 3

Extractable substance content related to a material with a moisture content equal to the regain, c_{gr}

	Extraction with				
	polar structure solvents			non polar str. solv.	
No.	ethylic alc.	isopropyl alc.	butyl alc.	benzene	toluene
1	1.44	0.88	0.69	1.03	1.05
2	1.34	0.88	0.67	0.47	0.63
3	0.89	0.35	0.48	0.79	0.87
4	0.31	0.16	0.19	0.28	0.22
5	1.79	0.69	0.68	1.53	1.47
6	1.05	0.43	0.45	0.42	0.50
7	2.12	1.29	0.85	1.72	2.54
8	1.82	1.01	0.66	0.44	0.46
9	1.33	0.87	0.82	0.87	1.19
10	1.02	0.66	0.66	0.34	0.60
11	1.67	1.08	0.63	1.32	2.05
12	1.37	0.86	0.49	0.24	1.08
13	1.61	1.32	1.22	1.16	1.61
14	1.41	0.78	0.89	0.09	0.62
15	1.89	1.75	1.24	1.47	1.79
16	1.64	1.21	0.95	0.19	0.77
17	0.96	0.84	0.38	0.92	1.02
18	0.91	0.55	0.29	0.10	0.77
19	0.40	0.31	0.24	0.81	0.89
20	0.27	0.27	0.18	0.13	0.40
21	2.24	1.08	1.19	1.51	2.72
22	1.83	0.86	0.92	0.36	0.90

3. Results and Discussions. From Tables 2-4 one can observe a difference, sometime important, between the quantities of substances extracted with the solvents that we studied. It can be seen that the higher extraction ability have proved the polar structure solvents from group I in the case of the yarns that have not been treated with paraffin.

Among the polar solvents that have been taken into consideration, ethanol develops a much higher extraction capacity as compared to the other two alcohols (especially butyl alcohol). This behaviour, in corelation with the smaller molecule dimensions of ethanol may lead to the conclusion that waxy substances are present not only in the primary layer of the cotton fibre, but also in the inner zones, hard to be penetrated by the solvents with big molecules.

Table 4

Extractable substance content related to the dryed and extracted material weight, C_g

No.	Extraction with polar structure solvents			non polar str. solv.	
	ethylic alc.	isopropyl alc.	butyl alc.	benzene	toluene
1	1.60	0.98	0.76	1.14	1.16
2	1.50	0.98	0.74	0.52	0.70
3	1.01	0.40	0.55	0.89	1.00
4	0.35	0.18	0.22	0.32	0.25
5	2.00	0.76	0.75	1.71	1.76
6	1.17	0.48	0.50	0.46	0.55
7	2.35	1.41	0.93	1.90	2.83
8	0.35	0.18	0.22	0.32	0.25
9	1.47	0.95	0.89	0.96	1.31
10	1.12	0.72	0.72	0.37	0.66
11	1.86	1.19	0.69	1.47	2.30
12	1.52	0.95	0.54	0.27	0.19
13	1.83	1.50	1.38	1.30	1.83
14	1.60	0.87	1.01	0.10	0.70
15	2.04	1.89	1.33	1.58	1.93
16	1.77	1.30	1.02	0.21	0.82
17	1.01	0.87	0.40	0.95	1.07
18	0.94	0.57	0.30	0.11	0.77
19	0.45	0.35	0.27	0.90	0.99
20	0.30	0.31	0.20	0.15	0.45
21	2.51	1.19	1.52	1.68	3.07
22	2.04	0.94	1.01	0.40	0.99

Among the low polarity solvents in group II, toluene proves the best extraction activity. As compared to benzene, toluene still presents a low polarity of the molecule and this might prove that the extracted substances are paraffin and natural admixtures as well (being known that waxy substances have in most cases a polar structure). It has been shown before the good extraction ability of toluene for natural wax of cotton. [7] From this point of view toluene could be compared with clorophorm, the solvent recommended by the Romanian Standard for wax extraction. Toluene extracts a great deal of polar structure technological auxiliaries (such as spinning oils, softening agents, etc.). This is proved by the relative great value of extracted substance from yarns that have not been covered with paraffin comprising only such admixtures.

The molecule of benzene has no polarity and as a result the substances extracted by benzene from the yarns covered with paraffin consist mostly in paraffin. Such behaviour is confirmed by the very low quantities of substances extracted from the yarns that have not been treated with paraffin when using benzene as

solvent. Consequently it can be considered that the degree of paraffin charging of the cotton yarns might be determined using benzene for extraction with 24-30 ebbings (6 ebbings per hour).

4. Conclusions. The solvents that we studied have different extraction abilities of natural extractible admixtures of cotton and paraffin. In order to estimate the paraffin content, benzene can be used for extraction with good results because of its very low ability for natural admixture extraction (especially the polar structure ones). Among the tested polar structure solvents, ethanol proved the highest extraction ability for the waxy substances and other natural extractable admixture of cotton, especially reducting substances (such as oligosaccharides), while the capacity of extracting paraffin is very low.

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CERCETĂRI ASUPRA EFICIENŢEI UNOR SOLVENŢI ORGANICI ÎN EXTRAGEREA CERURILOR NATURALE ŞI A PARAFINEI DE PE FIRELE DE BUMBAC ŞI TIP BUMBAC

(Rezumat)

Lucrarea urmăreşte evaluarea capacităţii de extracţie a unei serii de solvenţi organici faţă de cerurile conţinute de firele de bumbac şi faţă de parafina depusă pe aceste fire şi pe firele tip bumbac cu conţinut de celofibră şi poliester. Solvenţii studiaţi au fost grupaţi în două categorii în funcţie de polaritatea moleculei. Rezultatele obţinute au fost exprimate în trei variante prin raportare la masa materialului, la masa materialului cu umiditate egală cu repriza şi la masa materialului uscat şi extras. Sînt stabilite corelaţii între caracteristicile structurale ale solvenţilor studiaţi şi capacitatea lor selectivă de a extrage substanţele ceroase şi parafina. Se fac propuneri de solvenţi ce pot fi utilizaţi pentru a evalua gradul de încărcare cu parafină al firelor.

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TEXTILE. PIELĂRIE

MATHEMATICAL MODELING OF THE EQUILIBRIUM PICKLING OF PELTS

BY
FLORIN VITAN, NICOLAE BADEA,
STELIAN SERGIU MAIER and ALEXANDRU MĂLEANU

1. Introduction. Pickling has the aim, among others, to bring bated pelt to a prescribed acid value of pH and to accomplish deliming.

The lowering of the pH value of bated pelt must be done carefully, to avoid acid swelling, in presence of an amount of neutral salt, able to assure an imposed concentration in pickling float.

The transition from bated pelt to the pickled one is done by changing its water content, which is explained by the decreasing of hydration degree of pelt from a value corresponding to a light alkali medium, to a smaller one, which theoretically corresponds to the value of the isoelectric point [1].

That's why, during pickling, a certain amount of water is released and joins the initial float, increasing seriously the amount of final float.

It is very important to know this value of the final float not only for pickling but also for tanning, especially when operating in the same bath (a case frequently met in practice).

When tanning in final pickling bath, the real amount of float must be taken in account, in order to adjust it correctly, because it is necessary to obtain high concentrations of tanning salts.

These reasons shown above justify a more attentive analysis of pickling, because knowledge and experience allow nowadays a "theoretical design" of pickling technologies.

2. Establishment of the Equilibrium Pickling Technology. The main idea of this paper is that pickling technology must be established in tight correlation with the tanning technology, when these operations are carried out in the same, bath. If, from technological considerations, it results an imposed value of the tanning float, we may interfere by changing the amount of fresh water added to the pickling float in order to obtain, after this operation, the prescribed value of the float.

On the other hand, to provide a correct pickling (with insignificant swelling) must be ensured a minimal concentration of salt which depends, obviously, on the amount of fresh water added when preparing pickling float.

Further there are presented the determinations and the evaluations necessary for theoretical calculation of equilibrium pickling formulation, using a neutral salt, able to ensure a minimal concentration c_s (related to the entire amount of water of the system: float and water content of bated pelt) and a single acid with initial concentration c_a per cent weight, so that the final pH should be p.

In a first stage the composition of the limed pelt must be determined (hide substance, moisture and mineral salts content). It is presumed that for the bated pelt it was found the following composition: a_1, per cent hide substance; b, per cent calcium oxide; u_1, moisture (water).

For pickled pelt the composition may be established only at the end of the operation. Because it is necessary to know it for the establishment of the pickling recipe, in a reasonable range of precision, accepted in practice, the composition of pickled pelt can be assumed to be that presented in literature [2].

For pickled pelt let us set: a_2, per cent hide substance (with values between 30-35 per cent according to the literature); u_2, per cent moisture.

(Note: obviously $a_2 + u_2 = 100$ per cent.)

The establishment of pickling formulation presumes the calculation of the neutral salt amount, S (kgs), of the commercial acid quantity, CAQ (kgs), (which is an aqueous solution with c_a per cent weight acid concentration), of the mass of water requested to dilute the acid, WD (kgs), of the amount of fresh water, FW (kgs), and of course, of the quantity of final float, F (kgs).

All this amounts are calculated for a LP (kgs) mass of limed pelt.

The amount of final float, F, is given by the relation:

$$F = S + WFP + AW \tag{1}$$

where: S – amount of neutral salt; WFP – amount of water from pelt; AW – amount of added water.

(Note: when calculating the amount of float, the presence of compounds such as calcium salts and others is neglected, because they are in very small quotas.)

The amount of water that comes out from the pelt during pickling is given by the difference between the weight of pelt, LP, and the weight of picklied pelt, PP:

$$WFP = LP - PP \tag{2}$$

It is possible to correlate the amount of pickled pelt with that of the limed one, using the preservation relation of hide substance in pelt during pickling, and to write the following relation:

$$\frac{LP \cdot a_1}{100} = \frac{PP \cdot a_2}{100} \tag{3}$$

and so:

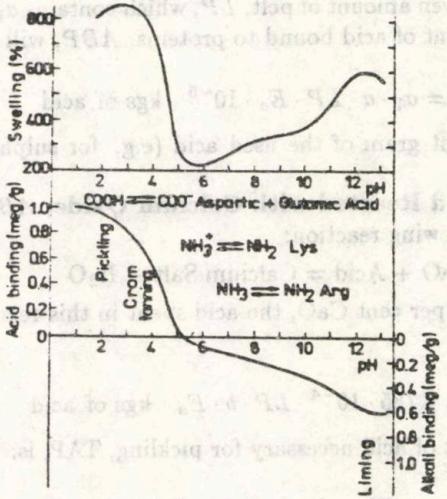

Fig. 1.– Correlation between the float pH, the pelt swelling and the acid/basis binding capacity

$$PP = LP \cdot \frac{a_1}{a_2} \tag{4}$$

The relation (2) becomes:

$$WFP = LP \cdot \left(1 - \frac{a_1}{a_2}\right) \tag{5}$$

The amount of added water consists of the fresh water, FW, and the water from acid used to prepare the pickle float, WAS:

$$AW = FW + WAS \tag{6}$$

The quantity of water, WAS, consists of the water from initial acid solution, c_a per cent weight concentration, and from the water used to dilute the acid, because of the fact that acids are always used diluted, in a ratio of n kgs water per 1 kg acid solution, c_a per cent concentration (usually $n = 10$).

In order to calculate the amount of water, WAS, first it must be calculated the amount of acid requested in pickling. This calculation is carried out taking in account the acid reacted with corium proteins (collagen) and also the acid reacting with calcium left in pelt.

3. The Amount of Acid Necessary for the Reaction with Corium Proteins is determined using the acid binding capacity curve of pelt, depending on pH, shown in Figure 1.

For an imposed pH value, p, it results from Figure 1 a value a meq acid/gr of protein, for the acid binding capacity of pelt.

As it follows, for a given amount of pelt, LP, which contains a_1 per cent weight hide substance, the amount of acid bound to proteins, ABP, will be:

$$ABP = a_1 \cdot a \cdot LP \cdot E_a \cdot 10^{-5} \quad \text{kgs of acid} \tag{7}$$

where E_a is the equivalent gram of the used acid (e.g. for sulphuric acid, $E_a = 49$ g).

4. The Amount of Acid Reacted with Calcium Oxide, ABC, is calculated taking in account the following reaction:

$$\text{CaO} + \text{Acid} = \text{Calcium Salt} + \text{H}_2\text{O} \tag{8}$$

If the pelt contains b per cent CaO, the acid spent in this reaction is given by the following relations:

$$ABC = 1.785 \cdot 10^{-4} \cdot LP \cdot b \cdot E_a \quad \text{kgs of acid} \tag{9}$$

So, the entire amount of acid necessary for pickling, TAP, is:

$$TAP = ABP + ABC = (a_1 \cdot a + 17.85 \cdot b) \cdot LP \cdot E_a \cdot 10^{-5} \tag{10}$$

The amount of the solution, with c_a per cent weight concentration, containing TAP kgs of acid will be:

$$CAQ = \frac{(a_1 \cdot a + 17.85 \cdot b) \cdot LP \cdot E_a \cdot 10^{-3}}{c_a} \quad \text{kg's} \tag{11}$$

whilst the amount of water contained by this solution is:

$$TAP \cdot \left[\frac{100}{c_a} - 1\right]$$

If the initial acid solution is diluted with water in a ratio of n kgs water for 1 kg acid solution, the amount of water added to the float together with the acid will be:

$$WAS = TAP \cdot \left(\frac{100}{c_a} - 1\right) + \frac{TAP \cdot 100}{c_a} \cdot n = TAP \cdot \left[\frac{100}{c_a}(1+n) - 1\right] \text{ kgs} \tag{12}$$

or, cosidering relation (10):

$$WAS = (a_1 \cdot a + 17.85 \cdot b) \cdot \left[\frac{100}{c_a}(1+n) - 1\right] \cdot LP \cdot E_a \cdot 10^{-5} \text{ kgs} \tag{13}$$

The amount of neutral salt, S, must be calculated so that it will ensure the concentration c_s towards the total amount of water of the system. The total amount

of water consists of float ($WFP + FW + WAS$) and the water from the pickled pelt, which depends on its moisture and is equal to:

$$\frac{u_2 \cdot LP}{100} = \frac{u_2 \cdot a_1 \cdot LP}{100 \cdot a_2}$$

From the definition of the salt concentration, c_s:

$$\frac{100}{c_s} = \frac{\frac{u_2 \cdot a_1 \cdot LP}{100 \cdot a_2} + LP\left(1 - \frac{a_1}{a_2}\right) + FW}{S} + \\ + \frac{(a_1 \cdot a + 17.85 \cdot b)\left[\frac{100}{c_a} \cdot (1+n) - 1\right] \cdot LP \cdot E_a \cdot 10^{-5}}{S} \tag{14}$$

it results the neutral salt amount, given by the relation below:

$$S = c_s \cdot LP \cdot 10^{-4} \cdot \left\{ \frac{u_2 \cdot a_1}{a_2} + 100\left(1 - \frac{a_1}{a_2}\right) + \frac{100FW}{LP} + \right. \\ \left. + (a_1 \cdot a + 17.85 \cdot b)\left[\frac{100}{c_a} \cdot (1+n) - 1\right] \cdot E_a \cdot 10^{-3} \right\} \tag{15}$$

The amount of salt S being found out, it can be calculated the final float, F, from relation (1), using also the relations (5), (6), and (13), as shown below:

$$F = LP \left\{ \frac{c_s \cdot a_1 \cdot u_2 \cdot 10^{-4}}{a_2} + \left(\frac{c_s}{100} + 1\right)\left[\left(1 - \frac{a_1}{a_2}\right) + \frac{FW}{LP} + \right. \right. \\ \left. \left. + (a_1 \cdot a + 17.85b)\left[\frac{100}{c_a} \cdot (1+n) - 1\right] \cdot E_a \cdot 10^{-5}\right]\right\} \tag{16}$$

From relation (16) it results the possibility to obtain a minimal float, which corresponds to the case when the amount of fresh water, FW, is zero, so:

$$F_{\min} = LP \left\{ \frac{c_s \cdot a_1 \cdot u_2 \cdot 10^{-4}}{a_2} + \left(\frac{c_s}{100} + 1\right)\left[\left(1 - \frac{a_1}{a_2}\right) + \right. \right. \\ \left. \left. + (a_1 \cdot a + 17.85 \cdot b)\left[\frac{100}{c_a} \cdot (1+n) - 1\right] \cdot E_a \cdot 10^{-5}\right]\right\} \tag{17}$$

It is possible to define a coefficient of final float, f, as a ratio between the amount of final float, F, and the stock of pickled pelt, PP:

$$f = \frac{F}{PP} = \frac{F \cdot a_2}{LP \cdot a_1} \quad \frac{\text{kgs final float}}{\text{kgs pickled pelt}} \tag{18}$$

Replacing relation (16) in relation (18) it results:

$$f = \frac{a_2}{a_1}\left\{\frac{c_s \cdot a_1 \cdot u_2 \cdot 10^{-4}}{a_2} + \left(\frac{c_s}{100}+1\right)\left[\left(1-\frac{a_1}{a_2}\right) + \frac{FW}{LP} + \right.\right.$$

$$\left.\left. +(a_1 \cdot a + 17.85 \cdot b)\left[\frac{100}{c_a}\cdot(1+n)-1\right]\cdot E_a \cdot 10^{-5}\right]\right\} \tag{19}$$

The minimal float coefficient results from relation (19), when $FW = 0$:

$$f_{\min} = \frac{a_2}{a_1}\left\{\frac{c_s \cdot a_1 \cdot u_2 \cdot 10^{-4}}{a_2} + \left(\frac{c_s}{100}+1\right)\left[\left(1-\frac{a_1}{a_2}\right) + \right.\right.$$

$$\left.\left. +(a_1 \cdot a + 17.85 \cdot b)\left[\frac{100}{c_a}\cdot(1+n)-1\right]\cdot E_a \cdot 10^{-5}\right]\right\} \tag{20}$$

When the final pickling float is imposed as part of the future tanning float, from relation (16) it is possible to find out the amount of fresh water, FW, needed to prepare the pickling float. So, at the end of pickling operation, it results the prescribed amount of float.

Explaining relation (16), connected with FW, it is possible to write:

$$FW = \frac{F - \dfrac{LP \cdot c_s \cdot a_1 \cdot u_2 \cdot 10^{-4}}{a_2}}{1+\dfrac{c_s}{100}} -$$

$$- \frac{LP \cdot \left(\frac{c_s}{100}+1\right) \cdot \left\{1-\frac{a_1}{a_2} + (a_1 \cdot a + 17.85 \cdot b) \cdot \left[\frac{100}{c_a}\cdot(1+n)-1\right]\cdot E_a \cdot 10^{-5}\right\}}{1+\dfrac{c_s}{100}} \tag{21}$$

To exemplify the way of using the above established relations in pickling operation, it will be considered the following case:

– it is assumed that tanning will be provided in pickling float, which will have the value $F = 130$ kgs water for 100 kgs pelt (the usual notation $F = 130$ per cent), at the end of this operation;

– an equilibrium pickling is processed using sulfuric acid with a concentration $c_a = 96$ per cent weight, diluted in advance with water in a ratio $n = 10$ kgs water for 1 kg acid solution with the above concentration;

– as neutral salt it is used sodium chloride which has to ensure a 5 per cent concentration (c_s) reported to the entire amount of water from the system;

– the pH of the float has to be 3.3;

– analyzing the bated pelt, it was found out the following composition:

– $a_1 = 20$ per cent hide substance;

– b = 0.06 per cent mineral substances expressed in calcium oxide;

– for pickled pelt, the evaluated composition [2] is:

– $a_2 = 30$ per cent hide substance;

– $u_2 = 70$ per cent moisture.

From the curve drawn in Figure 1, for the prescribed pH, $p = 3.3$, the binding capacity of the acid with hide substance is determined, being $a = 0.8$ meq acid/gr. of protein.

All these being done, the calculation of pickling formulation follows the below order:

1) From relation (21) it is calculated the amount of fresh water, FW, part of pickling float, so that, at the end of the operation, the final float should be $F = 130$ kg's water/100 kg's pelt.

(Note: the calculation is performed for a quantity of pelt, $LP = 100$ kgs, which means that in all relations to be used, $LP = 100$ kgs.)

$$FW = \frac{130 - \dfrac{100 \cdot 5 \cdot 20 \cdot 70 \cdot 10^{-4}}{30}}{1 + \dfrac{5}{100}} - 100 \cdot \left(\frac{5}{100} + 1\right) \cdot$$

$$\cdot \frac{\left\{1 - \frac{20}{30} + (20 \cdot 0.8 + 17.85 \cdot 0.06) \cdot \left[\frac{100}{96} \cdot (1 + 10) - 1\right] \cdot 49 \cdot 10^{-5}\right\}}{1 + \dfrac{5}{100}} =$$

$$= 79.5 \frac{\text{kgs fresh water}}{100 \text{ kgs pelt}}, \quad \text{or } 79.5 \text{ per cent}$$

2) The amount FW, of fresh water being found out, from relation (15) it is calculated the quantity of sodium chloride which ensure a 5 per cent concentration in float:

$$S = 5 \cdot 100 \cdot 10^{-4} \cdot \left\{\frac{70 \cdot 20}{30} + 100 \cdot \left(1 - \frac{20}{30}\right) + \frac{100 \cdot 79.5}{100} + \right.$$

$$\left. + (20 \cdot 0.8 + 17.85 \cdot 0.06) \cdot \left(\frac{100}{96} \cdot 11 - 1\right) \cdot 49 \cdot 10^{-3}\right\} =$$

$$= 8.41 \frac{\text{kgs NaCl}}{100 \text{ kgs Limed pelt}}$$

3) The required amount of sulfuric acid of 96 per cent weight concentration is given by relation (11):

$$CAQ = \frac{(20 \cdot 0.8 + 17.85 \cdot 0.06) \cdot 100 \cdot 49 \cdot 10^{-3}}{96} = 0.871 \frac{\text{kgs } H_2SO_4 \text{ 96 per cent}}{100 \text{ kgs Limed pelt}}$$

4) If the acid solution is diluted in advance in a ratio of n kgs water/1 kg acid 96 per cent and, if taking in account the water from the initial acid, it is possible to determine the amount of water added to the float together with the acid, using equation (13):

$$WAS = (20 \cdot 0.8 + 17.85 \cdot 0.06) \cdot \left(\frac{100}{96} \cdot 11 - 1\right) \cdot 100 \cdot 49 \cdot 10^{-5} =$$

$$= 8.74 \frac{\text{kgs water}}{100 \text{ kgs Limed pelt}}$$

5) In order to check out the correctness of the calculations, the total float is calculated as sum of the amounts of the float components, found out in advance, to which it must be also added the quantity of water which comes out from the pelt, during pickling, from the equation (5):

$$WFP = 100 \cdot \left(1 - \frac{20}{30}\right) = 33.33 \frac{\text{kgs water}}{100 \text{ kgs Limed pelt}}$$

So:

$$F = FW + S + WAS + WFP = 79.5 + 8.41 + 8.74 + 33.33 =$$

$$= 129.98 \frac{\text{kgs final float}}{100 \text{ kgs Limed pelt}}$$

6) The minimal final float, when $FW = 0$, may be found out from relation (17), or, easier, subtracting from F the amount of fresh water, FW:

$$F_{min} = 130 - 79.5 = 50.5 \frac{\text{kgs float}}{100 \text{ kgs Limed pelt}}$$

7) The final float coefficient results from equation (18):

$$f = \frac{130 \cdot 30}{100 \cdot 20} = 1.95 \frac{\text{kgs float}}{\text{kgs Pickled pelt}}$$

In other words, in relation with pickled pelt, the amount of final float is 195 per cent instead of 96.66 per cent when pickling starts. This is explained by the fact that, during pickling, the amount of water released by the pelt, simultaneously with its loss of weight, is significant.

As it follows, the pickling formulation, for 100 kgs pelt, under the conditions above, established on theoretical bases, is: 79.5 per cent fresh water; 8.41 per cent NaCl; 0.87 per cent H_2SO_4 of 96 per cent weight concentration; 8.74 per cent water for acid dilution.

In order to perform fast calculations, the equations (21), (16) and (15) are given also as multiple diagrams, as shown in Figures 2 to 4.

When drawing these plots, it was assumed that pickled pelt contains $a_2 = 30$ per cent hide substance (according to the literature) and the pH is 3.3. At this value (as shown in Figure 1), $a = 0.8$ meq acid/gr. of protein.

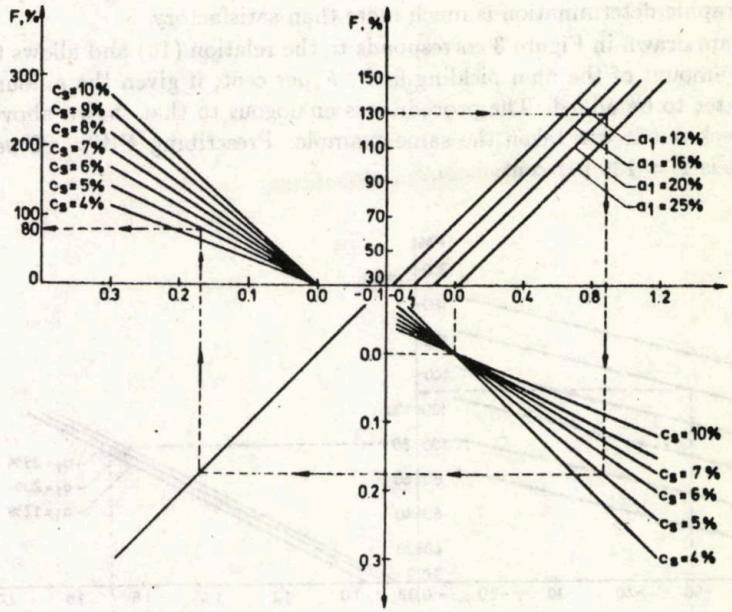

Fig. 2.– Multiple diagram to approximate the fresh float amount, $FW\%$, for an imposed final float, $F\%$.

In Figure 2 is shown the multiple diagram for equation (21), which allows the calculation of the fresh float amount, FW per cent, added to the pickling float, so that at the end of the operation, the final float should be F per cent (the amounts given in all Figures are referring to 100 kg's limed pelt).

To ease the understanding of multiple diagram's use from Figure 2, the data given in the example above will be taken in account.

Being prescribed the amount F per cent, a parallel to the abscissa is drawn till the intersection with the straight line corresponding to the amount of hide substance of limed pelt ($a_1 = 20$ per cent). From this point, another parallel is drawn to the ordinate till the intersection with the straight line corresponding to the prescribed concentration of neutral salt ($c_s = 5$ per cent). Through this third point, a new parallel is drawn to the abscissa, till the intersection with the straight line of the third sector and from that point, another one, to the ordinate is drawn till the intersection with the straight line of the second sector, corresponding to the concentration $c_s = 5$ per cent. The ordinate of this point gives the amount of

fresh water, FW.

Following the dotted line from Figure 2, it results that $FW = 80$ per cent, instead of 79.5 per cent calculated with relation (21), which certifies that the precision of the graphic determination is much more than satisfactory.

The diagram drawn in Figure 3 corresponds to the relation (16) and allows to determine the amount of the final pickling float, F per cent, if given the amount of the fresh water to be added. The procedure is analogous to that shown above, and for the check out it was taken the same example. Prescribing $FW = 80$ per cent, the result is $F = 130$ per cent.

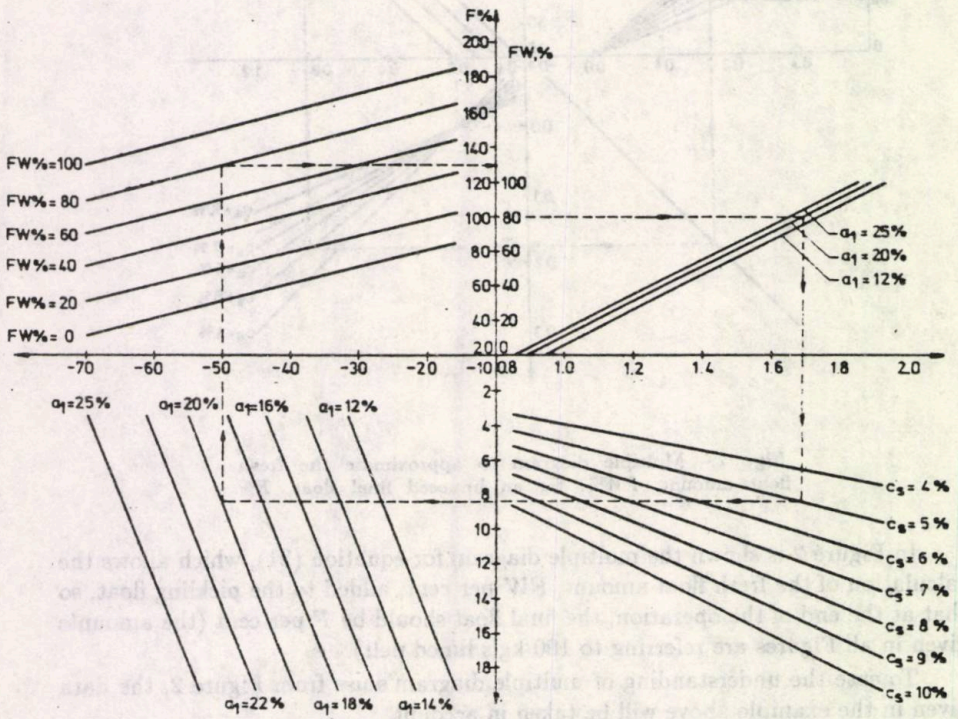

Fig. 3.– Multiple diagram to approximate the amount of final pickling float, $F\%<$ if the amount of fresh water to be added is given.

In Figure 4 is shown the multiple diagram for the equation (15), which allows fast determination of neutral salt amount ($LP = 100$ kgs), depending on the float amount, FW, found out anteriorly and the prescribed salt concentration, c_s.

For the same example, from Figure 4, it results $S = 8.4$ per cent, instead of the calculated value, from relation (15) of 8.41 per cent.

5. Conclusions. The equilibrium pickling may be theoretically modeled in order to establish the pickling formulation and to run this operation under prescribed

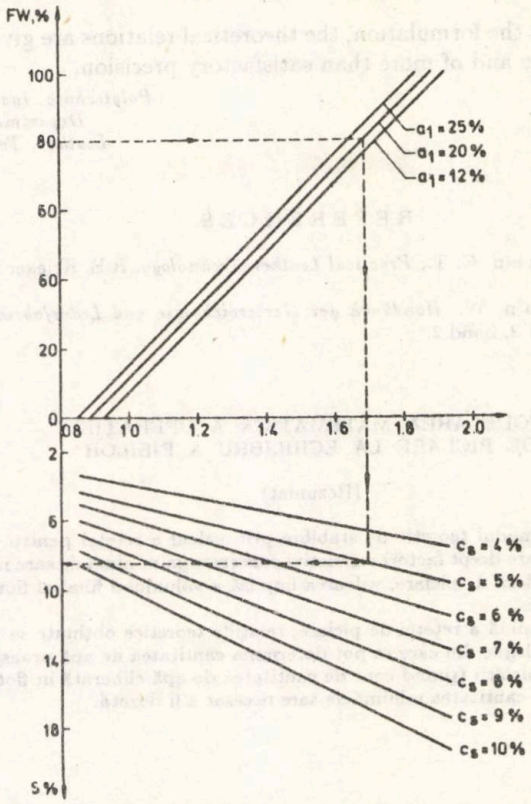

Fig. 4.– Multiple diagram to calculate the neutral salt amount, *S*%, need to use in pickling float.

conditions, which are important especially when tanning is processed in the final pickling float.

Even if the practical adjustment of the formulation theoretically established is necessary, because of the evaluations based on data found in literature (the composition of limed pelt and the binding capacity of corium) we think that, on basis of the theoretical formulation, the experimental effort will be considerably reduced, especially when the problem is solved by a skilled specialist. In any case, the experiments cannot be avoided, because the establishment of pickling technology presumes, besides formulation, the prescription of the operating parameters (i.e., the duration of the treatment according with the device used: drum or paddle), which today cannot be all evaluated with maximum of certitude on the grounds of pure theoretical arguments.

To establish fast the formulation, the theoretical relations are given as multiple diagrams, easy to use and of more than satisfactory precision.

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MODELAREA MATEMATICĂ A OPERAŢIEI DE PICLARE LA ECHILIBRU A PIEILOR

(Rezumat)

Lucrarea prezintă modul teoretic de stabilire prin calcul a reţetei pentru piclarea pieilor bovine, luînd în considerare drept factori restrictivi concentraţia minimă de sare industrială ce se doreşte a fi obţinută în flota de piclare, valoarea impusă a volumului final al flotei de piclare şi atingerea unui pH prescris.

Pentru stabilirea rapidă a reţetei de piclare, relaţiile teoretice obţinute se prezintă şi sub forma unor diagrame multiple din care se pot determina cantitatea de apă proaspătă adăugată, volumul flotei la finalul piclării (ţinînd cont de cantitatea de apă eliberată în flotă de către piei pe parcursul operaţiei) şi cantitatea minimă de sare necesar a fi dozată.

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STRUCTURAL AND QUALITATIVE CHANGES OF WORK STATIONS INTEGRATED IN A FLEXIBLE MANUFACTURING SYSTEM

BY

VIORICA FRUNZĂ and COSTACHE RUSU

1. Introduction. The present fashion tendencies require continuous changes and compell the garment manufacturers to accept small lot productions with frequent variations of colours and models; it is, therefore, difficult for them to plan and to optimize their production resources and their deliveries. Having this situation in mind the managers need to analyze, both globally and specifically, the various production processes operated with traditional sewing lines and to conceive new work stations that may help to solve these problems, as there are few investors in this area.

2. The Work Station Micro-system as a Structure Exposed to the Flexaction. In the manner of cybernetics the work station is the simplest system which achieves under the internal and external factors the first aggregation of the three fundamental elements of the production: equipment, human factor and work-piece [1].

The modern management and the industrial engineering tend to optimize this system in order to notice the new position of the human factor in the manufacturing because of the changes in the technical basis. The frequent criterion is the operators' productivity of the installed equipment.

The sewing line is a system including a lot of micro-systems (work stations) arranged in a specific configuration.

A work station micro-system includes elements and relationships able to operate the input (material, energy, information) and to get output.

In a sewing line different types of work stations (Fig. 1) mean:

a. if the work station is a manual one-including the operator (0), a simple tool (t) or a device (D) and the work piece (WP) – the productivity is determined by the operator's physical capability; the flexibility of such a structure could be assured only by the operator.

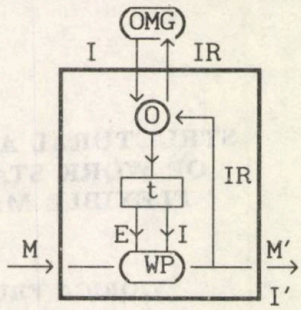
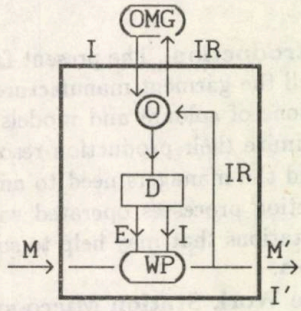
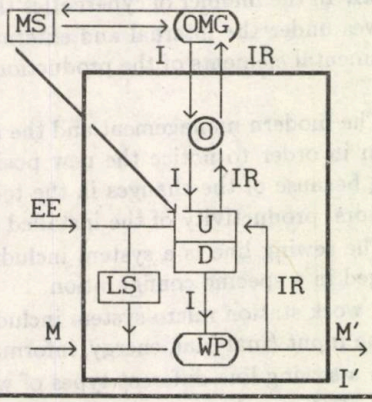
The work station type		The model of the work station as a micro-system
a.	a.1. manual-with simple tools	
	a.2. manual-with devices	
b.	b.1. manual-mechanical b.2. mechanized b.3. automatized	

Fig. 1.– The model of the work station as a micro-system integrated in the sewing line system. Elements: OMG – operative management; O – operator; t – tool; WP – work piece; D – device; U – machine; I – information (input); I' – information (output); IR – informational reaction; E – human energy; EE – external energy; LS – logistic system; MS – maintenance system; M – material (input); M' – material (output).

b. if the work station is mechanized or automatized and the energy (EE) to move the machine and the logistic system (LS) is carried from a central system (MS), the productivity is determined by the technical support-including the machine (U), the device (D) and the logistic system (LS) – the flexibility of such a structure is assured by these elements especially.

So the valid factors to guarantee application flexibility with minimum investment have to look out for changing the traditional sewing line system, in its structure and working [2].

3. The Technical Basis of a Sewing Line. The technical basis includes: machines, work piece handling system, network for reception and transmission, devices and control equipment.

The actual technical basis of the traditional sewing lines doesn't offer enough flexibility; for the next period, a short one, it is, therefore, necessary to concentrate on the following steps:

– using existing machinery (simple sewing machines) because the total re-equipment could not help to maximise the profits;

– fitting with devices all the machines, in order to concentrate several operations at one work station;

– using more work stations than there are operators;

– reducing the dimension of the traditional sewing line, according to the articles and models to be produced;

– installing a computer as a real-time control system of the sewing line, in order to adapt it, quickly, to a specific requirement;

– installing a logistic system.

In the near future the technical basis of the traditional sewing line will change its content becoming a global system able to adapt itself rapidly to every production change. The producers will have the possibility to decide among the following achievements:

– Modular Systems
– Multi Operation Machine
– Multi Operation System
– Fitted Work Station
– Programmable Units
– Production Data System
– Specific Single Operation Machines

These named achievements offer extreme flexibility from a technical point of view, but the problem is not solved totally. Abroad the record of flexibility is distributed to the firms as Yuki, Brother, Pfaff, Rimoldi, Kansai, etc., but at what price?

In the optimistic scenarios the sewing machine will be piloted by a microcomputer in order to realize automatically all the regulations of the sewing parameters: the length of the stitch, the pressure of the presser foot, the tension of the thread, etc. [3].

The conclusion is that the action to flexibilize the traditional sewing line aided by the technical components (machines, equipments, devices) has to achieve an equilibrum between universality (multi-operation machine) and specialization (specific single operation machine). In fact, unexpecting these "super-machines" it will be necessary to solve the requirements on flexibility by means of other components.

4. Changing the Human Factor to Be Integrated in a Flexible System. In the traditional work station the operator is responsible for an assigned operation, repeated many times. This repetition is efficient, but the work division limits his liberty to decide on the work method and to capture new information about it.

The flexible work station is conceived to create more responsability and authority. A high level of knowledge is essential in order to maintain both the performance and the competitivity too [4]. Traditional manufacturing often regards the operator as an extension of a machine and relies on supervisors to be the problem solvers with directions from management. In the flexible system the operator has to be regarded as a creative resource to be utilised.

The discrepancy between the evolution in techniques and the operators' level of training is growing up. For the future the differences among the advanced production systems will be not the technology but the "human capital", in a qualitative sense. That is why the cost for the work factor cannot be reduced. The economic success is attributed to the informational training too, which has to begin from the work station level; it could realize an easy control of production output and motivate the operators. So the flexibility of the human resource is also important as the technics is.

5. New Concepts to Manage a Flexible System. To achieve success a firm needs not only a skilled labour force, but above all, also a management to take the correct innovative decisions.

Except the physical differences in relation with the traditional manufacturing system, in a flexible system more important are the change in attitude required, which require the abandonment of some long-held operating principles. For many managers changing to a flexible system involve an element of learning a new management method.

An actual fact is that the sewing lines must be able to respond quickly and be able to change styles equally fast. In short, they must be able to produce a quality product with ever decreasing work-in-process time. This is possible with a flexible equipment and a labour developed to minimise the disruptive effect of changeovers. These are some principles of the Just-in-Time method.

Adopting the Just-in-Time method in the Romanian Garment Manufactures means ending the practice of lots of work-in-progress, which is indeed in stark contrast to traditional manufacturing.

There are chances to implement this solution of organisation in the context of the next structural changes of the Romanian economical system.

6. Conclusions. The traditional work station needs to become a flexible unit integrated in specific system – the sewing line – not as an universal solution, but a way to respond to a certain requirement.

Adopting the idea that flexibility solves all the problems of the modern manufacturing could mean the investment in a sophisticated technical basis and a high cost of production. Romanian Garment Manufactures need to include the whole area of factors in their intention to change the traditional systems, a few flexible.

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SCHIMBĂRI STRUCTURAL-CALITATIVE ÎN LOCURILE DE MUNCĂ INTEGRATE UNUI SISTEM FLEXIBIL DE FABRICAŢIE

(Rezumat)

Se prezintă un punct de vedere cu privire la modificările de operat pentru a flexibiliza un sistem de fabricaţie – linia tehnologică de confecţionare – cu referire la: baza tehnică, forţa de muncă şi metodele şi tehnicile de conducere.

Se consideră că o astfel de abordare, de la nivelul micro-sistemului locului de muncă este justificată pentru a fundamenta oportunitatea unui sistem flexibil.

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